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Observations on the Clinical Aspects of Reproductive Disorders in Cattle*

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INTRODUCTION

To-day, infertility in dairy cattle is one of the major problems which confront us. Interest in the subject was quickened during the early days of the war by the activities of the Survey Committee of the N.V.M.A., and it cannot be gainsaid that that body through the medium of its publications and itinerant teachers did much to make us *au fait* with the existing state of knowledge. Since that time we have all been engaged in its study and a discussion based on personal experiences cannot but be fruitful. But before proceeding to a consideration of our own observations, the work of the pioneers in this field should be reviewed, lest it be forgotten how much of what we say to-day is the outcome of that work. Sterility in the bovine occupied a prominent place in the discussions at the ninth International Veterinary Congress at The Hague in 1909, and the principal speakers were Hess, of Switzerland, and Albrechtsen, of Denmark. Hess propounded the view that the essential abnormalities lay in the ovaries; cystic changes and persistence of the corpus luteum. It was he who introduced the operation of expression of the corpus luteum. Albrechtsen, on the other hand, while recognising the ovarian changes, held that the primary cause was infection of the tubular portion of the tract, particularly the uterus. He introduced the treatment of iodine irrigation. Little attention was paid to the subject in this country until W. L. Williams, the American worker, published in 1919 his book on diseases of the genital organs. Amongst Williams' ardent disciples was J. R. Barker, and in 1923 he read a paper at our Annual Congress, which aroused considerable interest. In 1924 L. P. Pugh published a valuable paper on irregularities of the oestrus cycle, and later in the same year F. Nielsen, of the Danish school, was invited to this country to demonstrate his methods of diagnosis and treatment. In 1926, Nielsen read a comprehensive paper on the subject at the Annual Congress. Since that time interest in the matter has been world-wide and a voluminous literature has developed. The generally accepted view is that the most important causes of infertility lie in infection of the uterus, the cervix and the oviducts. It will be recalled that the Survey Committee formed the conclusion that 90 per cent. of cases were due to varying degrees of endometritis, and one of its chief recommendations in regard to treatment was irrigation of the uterus by the Danish method. The Committee's views, however, were not unanimously accepted and notable amongst the dissentients were members of the Western Counties Division. It is my belief that the view that the chief cause of infertility is endometritis now requires modification. The recognition of *Trichomonas foetus* infection (Riedmuller, Abelein and others) was a milestone in our knowledge, and since the first report of its existence in this country in 1937 by Stableforth, Scorgie and Gould, many outbreaks have come to light. Gould has given us a good picture of its clinical features, while Kerr and others have added to our knowledge. There can be little doubt that much of the confusion of the past was due to the non-recognition of this disease, for now that we are cognisant of it the apparently opposing views of early workers become largely reconciled. Rowson in 1942 made a valuable contribution when he drew attention to the frequency with which adhesions of the ovaries to the ovarian bursae were found on *post-mortem* examination. The condition had also been recorded in America by Williams in the 1939 edition of his book. Other advances have been concerned with the use of oestrogenic hormones in the treatment of breeding irregularities, particularly stilboestrol dipropionate and pregnant mare's serum.

When I first interested myself in the subject it at once became apparent that if I was to progress, much closer attention to the fundamentals—the anatomy and physiology of the genital organs—would be necessary. The degree of detailed knowledge required for an understanding of these organs is greatly increased by the numerous changes in form, structure and position they undergo during their various functional phases; changes controlled by an elaborate and complex hormone mechanism. In this connection I would pay tribute to the fundamental studies of Hammond on the physiology of bovine reproduction, for his work gives us a solid foundation on which to build. Accuracy in diagnosis is the basis of clinical science, and as it relates to the subject under consideration, entails ability to detect in the living animal not only the abnormal conditions to which it is known the genital organs are prone, but in addition, the changes which occur within the limits of normal function, including pregnancy. Manipulation of the genital organs *per rectum* is our most important clinical aid, but we are able also to examine the vulva, vagina and external parts of the uterine cervix visually and in most cases manually. We are also able to collect from them material for microscopical and bacteriological examination. Correctly to interpret one's findings by a method of examination so prone to error as rectal manipulation, it is essential that we shall at least have seen and handled genital organs in health and disease on the *post-mortem* room table, and it is on this premise that I base my remarks to-day.

Before passing to the subject of infertility we might well ponder a moment on the amazing complexity of the normal processes of reproduction. It is a long and tortuous road from maturation of the ovum and the act of coitus to the delivery of a living, full-term foetus. Should this complex process break down at any point, perfect reproduction will fail and the animal become, if only temporarily, infertile. There can be little doubt that many accidents may occur during the early life of the free ovum or the embryo, accidents hardly accountable under the accepted conception of pathology whereby development is interrupted and the process fails. Under the best conditions of animal husbandry there will always be infertile matings. Frequently it is found that a cow fails to conceive to three, four or even more services by a fertile bull, yet she later conceives and carries her calf without any treatment or interference whatever.

The cow has come to be regarded as a machine for the production of milk for human consumption. That Nature intended lactation to ensure the welfare of the newly born calf is forgotten, as also is the fact that the natural time for reproduction is the spring when the food supply of the mother is assured. Under modern conditions of dairy husbandry cows are required to calve at all seasons, and it is probable that many of the irregularities later to be referred to are Nature's protest against this practice. There appears to be a marked tendency for calving time to work round to the spring again, and the practice of withholding service from cows in order to get winter calves is often attended by serious loss of breeding time.

ABSENCE OF VISIBLE OESTRUM

In my experience the commonest breeding irregularity is the absence of detectable signs of heat in non-pregnant animals. But in considering this aspect of infertility we must not lose sight of the human factor in animal husbandry, for there are great variations in the skill possessed by cowmen in the recognition of heat. Some are most efficient and are able to detect the slightest change in the behaviour of their charges, but from this peak of efficiency there are marked downward gradations. There is little doubt that many cases included under this heading would have mated had they been running with the male, whereas under conditions of housing their heat has been unobserved. It cannot be disputed that by adopting such practices as running the cows in a yard daily or walking the bull through the cowshed, many cases will be detected which otherwise would have been overlooked. Despite these precautions many animals will be met in which the sexual urge of oestrum is absent. The clinical indications of the condition vary. Heifers may attain sexual maturity and show no heat cycles. Cows after calving may go several months without return to visible oestrum, while others show heat only at long and irregular intervals. A cow after parturition may show one or two heat cycles and then relapse into a prolonged state of sexual quietude. When such an animal has been served, but has failed to conceive, a sense of false security arises, for attention to her is relaxed and months may elapse before she is "seen" again. In the ordinary commercial herd such an animal may then have ceased to be an economic proposition and when dry is disposed of to the butcher. In my opinion one of the most valuable features of the Survey Scheme is the routine examination of cows for pregnancy, so that the cases just referred to can be detected early and appropriately dealt with.

What are the findings on rectal examination in such cases? In the majority no abnormality is detected and a series of examinations

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indicates the ovaries to be undergoing their normal cyclical changes. (On several occasions in animals in which the findings have been typical of those of heat, artificial insemination has successfully been carried out.)

Suboestrum (Murray) or *Silent Heat* are the names applied to the latter condition. It is highly probable that many of the cases referred to in the past as "persistent corpus luteum" were, in fact, suboestrum, and the corpus luteum palpated was that of dioestrum, for in a random examination the chances are two to one that a corpus luteum of full development is present.

Two forms of treatment are in vogue: The first, enucleation of the corpus luteum by digital pressure, and the second, the intramuscular injection of an oestrogenic substance such as stilboestrol dipropionate. In our hands the first has been the more successful. In a series of 51 cases in which the result was followed up, visible heat occurred in 36 (70 per cent.) in a period of one to five days after operation. In 31 of these which were served or inseminated at the provoked oestrum, conception occurred in 18 (60 per cent.), and the majority of the remainder developed recurrent visible cycles. Of the 15 cases in which the operation was unsuccessful, three only developed early visible cycles and in the remainder suboestrum persisted. As yet we have not observed an animal suffer appreciable harm from the interference.

Using stilboestrol dipropionate in doses of 15 to 25 mg., in 18 cases, visible heat was induced in seven (39 per cent.) in from one to six days. Five of these were mated or inseminated at the induced heat but none conceived. In all seven, however, recurrent visible cycles developed. (The dosage of stilboestrol would appear to be a subject requiring much more experimental investigation. The action of graded doses throughout the various phases of the oestral cycle should be observed. We are all familiar with the marked variations in response which attend the use of the accepted doses in non-pregnant and pregnant animals, and also in cases of mummified foetus *in utero*.)

The facility with which the corpus luteum can be expressed will vary both in relation to its form and the time in dioestrum at which operation is attempted. As regards the former, the greater the degree of protrusion from the surface of the ovary, the easier is expression. In those cases in which the protrusion is small and nipple-like, complete enucleation may be difficult. As regards time, I would put the eighth to twelth day of dioestrum as the optimum. During early dioestrum the magnitude of the corpus luteum is insufficient for it to be greatly influenced by general pressure on the ovary, while towards the end of the period the serosa over its protrusion is becoming invaded by scar tissue which gives it support. (It is difficult, even when handling the ovary on the *post-mortem* room table, to express the corpus luteum of two months' pregnancy.)

Anoestrum.—Absence of heat due to functional quiescence of the ovaries. Rectal examination in such cases reveals the ovaries to be small and flat from side to side, neither a corpus luteum nor developing follicles being detected. At a second examination made as a check some ten to twelve days later, the condition is unchanged. It is of the greatest concern in heifers, especially those in poor condition. There appears naturally a period of sexual quietude after parturition, particularly when lactation is heavy, but when this continues for longer than three months it should be regarded as pathological. It is stated that this period is longer in animals suckling their young than in those being milked. Anoestrum is also common in adults which are debilitated from any cause. It seems probable that perfect sexual function is dependent on a high nutritional level and when debility exists either from dietetic causes or from disease, reproduction will suffer. There is a practice, particularly in these days of food shortage, to "do" heifers badly. The policy is a short-sighted one for the period is one of the most critical in the animal's life. Not only is she concerned with her own growth but will shortly be required to conceive and bear young in addition. In our experience a combination of a low dietetic level and parasitism is one of the common causes of anoestrum in heifers.

Pregnant mare's serum has been highly spoken of in its treatment. In our hands the agent has been singularly ineffective. In 23 cases, in heifers and first calvers, it was administered in doses of 1,500 to 3,000 units. Visible heat was induced in five (22 per cent.) only, in a period of three to eleven days. None conceived at the provoked heat. Some relapsed into anoestrum again and of the whole group only five showed the early onset of recurrent cycles. In order to evaluate the action of P.M.S. more accurately, the drug was administered to four heifers and close observation kept:—

March, 1944.—Four Friesian heifers, one and a half years old and in poor condition, which had never been seen in heat. Repeated rectal examinations revealed the ovaries to be small and unchanged.

Two thousand two hundred and fifty units were given by intramuscular injection to each and on each of the nine succeeding days they were allowed to run in a yard with a young bull. On no occasion would any of them stand.

Five days after injection follicles could be detected in the ovaries and the uteri were turgid. On the ninth day it was evident that *super* follicle development had occurred for seven of the eight ovaries concerned varied in size from a walnut to a hen's egg and follicles up to an approximate diameter of 2·5 cm. could be palpated. In each animal a yellow, opaque vulval discharge developed and in one this discharge could be seen exuding from the cervix on speculum examination. Cultural examination revealed no significant organisms. On the 16th day the ovaries were unchanged and each was submitted to vigorous squeezing but no indication of expression of a corpus luteum occurred. Thirty days after injection the ovaries had reverted to the anoestrus state.

In May the animals were turned out to grass and their condition improved. Natural oestrum commenced between August and November. The heifers were served and are now pregnant.

Cystic ovaries.—In addition to the accepted ovarian conditions associated with absence of heat, we recognise a third—"cystic ovaries." We have encountered it only in cows. The animal is not pregnant yet shows no sign of heat and examination reveals one or both ovaries to be enlarged. The impression imparted to the fingers is that they contain several cysts up to 2·5 cm. in diameter. Repeated examinations over a period of several months reveal no change. The condition is most common in the winter when the animals are housed but it has been encountered in the summer months. Squeezing of the ovaries may cause a cyst to rupture but this does not provoke heat nor any appreciable change in the condition. More often they are resistant to pressure. It tends to resolve naturally when the animal goes out to grass in the spring, but it may recur later in life. Stilboestrol dipropionate and pregnant mare's serum have been used in its treatment without avail. The following case record illustrates the condition:—

P.16.—Ayrshire. Born January, 1939. Attested.
24.5.41.—Calved (male).
20.8.42.—Calved (female).
9.9.42.—Served. No recurrence of heat.
14.12.42.—Examined. Not pregnant. Ovaries: right the size of a walnut, left a hen's egg. Both contained large cysts.
26.1.43.—Ovaries unchanged. P.M.S. 3,000 units given.
14.2.43.—Ovaries unchanged. No sign of heat as result of treatment. Stilboestrol 30 mg. given.
22.2.43.—Ovaries unchanged and no sign of heat.
19.3.43. Ovaries definitely changed; left contained a corpus luteum which was expressed by pressure; right small and flat.
23.3.43.—Oestrum. Served but did not conceive and suboestrum developed until—
3.6.43.—Oestrum. Served and conceived.
14.3.44.—Calved (female).
25.6.44.—Oestrum. Served but failed to conceive and suboestrum developed.
8.9.44.—Oestrum. Inseminated but failed to conceive.
20.10.44.—Examined. Both ovaries enlarged and contain fluctuating swellings. No sign of heat.
8.1.45.—Ovaries unchanged: right the size of a hen's egg, left smaller but similar. No sign of heat.
10.2.45.—Condition unchanged.
This animal has given a negative blood for *Brucella abortus* agglutinins throughout the whole time she has been in the herd and has been vaccinated with the Ministry No. 2 vaccine.

On several occasions we have had the opportunity of examining the ovaries of such cases *post mortem* and the following is typical:—

J.349.—Friesian. Born 5.7.38. Vaccinated as a heifer with the Ministry original live culture abortion vaccine. A reactor to the tuberculin test.
26.4.41, 4.4.42, 28.7.43.—Calved normally. She had been exposed to *T. foetus* infection *prior* to the last pregnancy but the parasite was not found.
21.8.43, 27.9.43, 9.11.43.—Oestrum and inseminated but failed to conceive.
From this time until May, 1944, when it was slaughtered, there was no sign of heat. The ovaries were examined on many occasions and were found to be abnormally large and contain cysts.
Post-mortem Findings.—Right ovary: dimensions 4·6 × 3·2 × 3·2 cm. A multilocular cyst of 2·6 cm. with no sign of luteinisation.
A second follicle of 0·8 cm. with some recent luteinisation of its wall. Several adventitious "strings" attached to the surface of the ovary but the fimbria, oviduct and bursa normal.
Left ovary: 3·8 × 2·6 × 3·0 cm. Three cysts of 2·5 cm. In the wall of one were localised areas of orange-coloured lutein tissue. Fimbria, oviduct and bursa normal. No other abnormalities were found in the genital organs.

One of my reasons for drawing attention to these cases is that in the cow cystic ovaries are regarded as being associated with an excess of heat. They may be, but the true nymphomaniac cow is comparatively rare, and in those which I have examined the ovaries on rectal examination have generally been indistinguishable from those of the condition under review. That cystic changes may be associated with marked variations in sexual behaviour is evidenced by the following case:—

J.367.—Friesian. Born 21.8.39.
18.7.42.—Calved. No sign of heat since.
18.11.42.—Examined. Uterine cornua small and flaccid. Right ovary: the size of a cricket ball with an irregular surface. Left ovary: small and insignificant.
Absence of heat continued until 18.3.43. The ovaries were examined on many occasions. The left remained unchanged but the right became progressively larger until it was the size of a coconut.
18.3.43.—Oestrum, and from this time the animal became nymphomaniac. The tail base became raised and the sacro-sciatic ligaments relaxed.
31.5.43.—The animal fell while mounting another cow and fractured the shaft of the right ilium.
Post-mortem Findings.—Right ovary: 18 × 12 × 7 cm. A mass of follicles of 0·2 to 0·5 cm., in a loose, oedematous stroma. No sign of lutein tissue. Histology (Dr. J. R. M. Innes)—a cyst adenoma. Left ovary: 4·8 × 2·0 × 1·2 cm. No significant structures. Uterus, bursae and oviducts—normal.

Frequent Return to Service

Animals which repeatedly fail to conceive to service by a known fertile bull and in which clinical and *post-mortem* examinations fail to reveal a cause, have already been referred to. Under this heading it is proposed to describe the pathological changes found in those in which abnormality is demonstrable on *post-mortem* examination. In some cases the infertility may be temporary only but more often it is permanent. While for purposes of clinical classification it is convenient to differentiate this group from that in which absence of heat is the chief feature of infertility, the division between them is arbitrary for animals of this group may be the victims of suboestrum.

Failure to ovulate with luteinisation of a single follicle.—It is frequently found on *post-mortem* examination that one of the ovaries is somewhat larger than can be accounted for by the normal variation which occurs during the oestrus cycle and squeezing indicates that this enlargement is due to distension by fluid. The contour of the affected ovary is regular and there is no sign of multiple cyst formation; nor is there a protrusion of a corpus luteum. Section reveals it to contain a large cyst, generally about 3·0 cm. in diameter, the wall of which is partially or completely lined by a layer of lutein tissue about 0·2 cm. in thickness. The condition differs from the one previously described as cystic ovaries because one ovary only is involved, the cyst is single and there is plentiful evidence of lutein tissue. Furthermore, the animal is having recurrent heat cycles and the coloured remnants of previous corpora lutea are evident. The following is an example of a typical case:—

> H.H.36.—Ayrshire. Born early 1939. Attested.
> May, 1941.—Calved. Blood positive for brucellosis.
> 7.8.41, 16.11.41, 31.12.41, 18.6.42, 6.7.42.—Served but failed to conceive.
> 9.9.42.—Oestrum.
> 15.9.42.—Slaughtered.
> *Post-mortem Findings.*—Right ovary: Dimensions 4·0 × 3·2 × 3·0 cm. Large and plum-like. No protrusion of a recent corpus luteum. Section: a large central cyst, 3·0 cm. diameter. The greater part of its wall lined by a layer of lutein tissue, orange-yellow in colour and 0·2 cm. thick. In addition a regressing corpus luteum of the first generation, scarlet in colour and of dimensions 1·0 × 0·4 cm. Left ovary: 3·5 × 2·5 × 1·8 cm. A follicle of 1·2 cm., and several red remnants. Genitalia otherwise normal.

On rectal examination the affected ovary is large and plum-like and a projection cannot be detected. At the same time, the sizes and shapes of normal ovaries show considerable variation, as also does the degree and type of projection of a normal corpus luteum. Thus it is improbable that the condition will be accurately diagnosed in life. There is no doubt that this is one of the conditions which has been described in the past as cystic corpus luteum, but a word of warning is necessary in this connection for there may be a fluid filled cavity in a normal corpus luteum of dioestrum.

In the very recent corpus luteum there is always a small central cavity but in the majority this becomes entirely filled by lutein tissue by the time the structure has attained full development. In a proportion of cases, however, and the writer's records put this proportion at about 25 per cent., the central cavity persists throughout the dioestral phase. Its size generally lies between 0·4 and 0·8 cm., but in exceptional cases it may be much larger. These cases can readily be distinguished on the *post-mortem* room table from the abnormality under discussion, for there is a protrusion and in the centre of it the minute depression from which ovulation has occurred can be detected. It may be asked—if such a corpus luteum is normal, is it ever seen in pregnancy? I have not seen one, but on a number of occasions the centre of the corpus luteum verum has been found to be occupied by white connective tissue and the conclusion is that during its early life it possessed a cavity.

Ovaro-bursal adhesions.—This is the commonest abnormality which we have encountered in a large series of *post-mortem* examinations of the genitalia of cattle. There are great variations in its degree. Ovaries are often seen in which strands of adventitious connective tissue are adherent to the surface and this is probably the precursor of the condition. In the simplest cases one or more thread-like adhesions occur between the ovary and the fimbria or the serosa of the bursa. If section of the ovary is made at the points of attachment, it will be found that the scar of a corpus luteum lies beneath them. In more advanced cases the fimbria is everywhere adherent to the ovary and the "mouth" of the bursa is obliterated although its cavity remains patent. In another group, in addition to the adhesions, the bursal wall is fibrosed and shrunken. In these the oviduct often shows evidence of strangulation with localised or diffuse distensions. Occasionally a local abscess will be found in such an oviduct. In the most advanced cases the bursa is entirely obliterated and the ovary completely obscured. The condition may be unilateral or bilateral, and when the former, the right side is more often involved. Not infrequently the ovary concerned contains a normal corpus luteum. The condition has been seen in unbred heifers but as a rule it is cows which are concerned. In the majority of cases there are no signs of active inflammation nor are inflammatory lesions found elsewhere about the genitalia, although in many cases of tuberculous ovariitis, salpingitis and peritonitis, similar adhesions are present. Many cases have been observed in America where the incidence of bovine tuberculosis is very low. It has been suggested that manual expression of the corpus luteum or other ovarian interference may be a cause, but we have seen a case in a cow that had not been subjected to rectal examination. We have not seen the condition, either unilateral or bilateral, in the examination of some 80 pregnant specimens, but conversely, unilateral adhesions have been found in animals which have failed to conceive over a long period. There is no doubt that it is one of the important causes of sterility in cattle.

I am unable to diagnose the condition accurately by rectal examination. In a number of cases, consequent on lack of mobility of an ovary and irregularity of its outline, adhesions have been suspected and this suspicion has been confirmed on *post-mortem* examination, but errors have also been made. Moreover, I am unable to detect and assess the state of the ovarian bursae during life with the degree of certainty necessary to merit the method being advanced as a reliable clinical aid.

Delay in ovulation.—Delay in ovulation is regarded by many as being an important factor in infertility. Hammond has established that the normal ovulation time is about 40 hours after the onset of heat and thus it is reasonable to assume that mating at any time during the period of acceptance will be fertile. Nevertheless, there is evidence associated with artificial insemination to show that conception rate is higher if the operation is performed late in the heat period. It would seem sensible when dealing with animals which do not conceive readily to reintroduce them to the bull some twelve hours or so after the first service, and if they still "stand" allow a second service. It is probable that under natural conditions several matings will occur during a heat period. As to the frequency with which ovulation is delayed long beyond the normal time, we have but little evidence and I do not regard conclusions drawn from the findings of rectal examination sufficiently reliable. Delayed ovulation cannot be distinguished clinically from luteinisation within the follicle. At the same time we have examined one animal *post mortem* in which ovulation had not occurred 76 hours after the animal was seen to be in heat. My own view is that the condition is not a frequent cause of infertility.

Infective Diseases of the Genital Organs

Tuberculosis. The importance of tuberculosis as a cause of sterility in cattle has been insufficiently stressed during the recent campaign. Quinlan put the disease as causing 18 per cent. of the sterility in cattle in South Africa, and I believe it will be found responsible for a no less percentage in infected herds in this country. Steward, in the examination of 79 random specimens of uterine discharge, found 30 per cent. to be positive for tubercle bacilli. Berger has recently redirected attention to the disease. In a herd of 70 cows (80 per cent. of which were reactors), recently investigated by us, nine were destroyed on account of continued infertility. The *post-mortem* findings are illuminating:—

> Two—No abnormality found.
> Two—Tuberculosis. (1) Left tuberculous salpingitis with ovaro-bursal adhesions. (2) Miliary tuberculous endometritis.
> Three—Ovaro-bursal adhesions without macroscopical signs of tuberculosis—two unilateral and one bilateral.
> One—Cystic ovaries associated with prolonged anoestrum.
> One—Large cyst-adenoma of the right ovary.

When examining cows for infertility in an infected herd, tuberculosis must be borne in mind. Little difficulty will be experienced in detecting those cases in which the uterus, oviducts and possibly ovaries are grossly enlarged and deformed, but in miliary tuberculosis of the endometrium enlargement may be inappreciable while early oviduct lesions also may escape detection. The advice of others, that vaginal discharges and particularly purulent discharges should be examined for acid-fast organisms, can only be reiterated.

Salpingitis. Pyogenic salpingitis is generally accepted as a frequent cause of sterility. It is orthodox to state that the anatomical arrangement of the bovine uterine cornua favours the spread of infection from them into the oviducts. I have misgivings as to the correctness of this view. Attention has already been drawn to the frequency of tuberculous salpingitis and also the involvement of the tubes in ovaro-bursal adhesions with hydrosalpinx and occasionally pyosalpinx, but apart from these conditions my experience leads me to regard tubal lesions as uncommon. The late Professor J. F. Craig examined histologically on my behalf the oviducts from two cases of pyometra, and found them to be normal. The belief that the tubes are seldom involved in pyometra is strengthened by the high percentage of such cases which conceive again when the condition has been overcome by appropriate treatment. Moreover, it is my belief that the primary aetiological factor in pyometra is structural changes in the endometrium associated with persistence of the corpus luteum.

Metritis. During the examination of considerable numbers of abattoir specimens of bovine genitalia, an outstanding impression was the comparative rarity of disease of the uterus and apart from tuberculosis and puerperal infections, the only abnormalities encountered were pyometra and cystic hypertrophy of the mucosa. Nothing was found which conformed to the chronic catarrhal and muco-purulent conditions which have been described as the common cause of infertility. Examination of the ovaries in the pyometra cases revealed the corpora lutea to be of the persistent type. (Persistent corpus luteum—resembling that of pregnancy; of maximum size, yellowish-orange to brown in colour; protrusion indistinct and the serosa over it fibrosed, and not expressed by reasonable pressure to the ovary.) Out of six cases, a striking feature of three was the presence of multiple corpora lutea in one ovary; in one—triplet, and in two others—twin. The pus was of two types; the first—glutinous in consistency and yellow or greenish-white in colour, and in these the cervix was occupied by tenacious mucus similar to that of pregnancy, and the second—fluid, white or greyish-white and of the consistency of "pea soup." In this group also the cervix was closed but its mucus was more moist and subsequent experience leads me to believe these to have probably been trichomonas cases. In one of the first group, a foetus 1 cm. long was found complete in its membranes. The fact of the corpora lutea being persistent struck me as being of great significance and having in mind the analogy of the bitch in which subject pyometra occurs during the period of pseudo-pregnancy when the corpora lutea are persistent, I was inclined to the view that it was a primary factor.

Since preparing the previous statement, a cow has been encountered in which pyometra was associated with cystic ovaries, one of the cysts being luteinised. The animal was attended during life and a *post-mortem* examination was made. Other interesting features of the case were that there was an intermittent vulval discharge and the nature of the uterine exudate was different from that seen in previous cases, being "milk chocolate" in colour. Details are as follows:—

Ps.1.—A multiparous, cross-bred Friesian. Last calving August, 1944. From that time until the animal was inseminated in December, 1944, heat cycles were normal. There was no recurrence of heat after insemination but an intermittent vulval discharge was noticed. This was positive for *C. pyogenes* but negative for *Mycobact. tuberculosis*. When examined on 1.3.45, she was found to be not pregnant. The uterus was flaccid but not appreciably enlarged. The right ovary was the size of a hen's egg and cysts could be detected, while the left ovary was small and of no significance.

Post-mortem Examination 26.3.45.—The uterine cornua were each distended to a breadth of 6 cm. and occupied by muco-pus, "milk-chocolate" in colour. The endometrium of both cornua showed slight pigmentation and a pin-head, nodular hypertrophy. There was no sign of cotyledons. There was no evidence of ulceration or recent haemorrhage.

The dimensions of the right ovary were 6·0 × 4·0 × 3·6 cm. Protruding from its surface were four cysts, 4·0, 3·8, 2·8 and 2·0 cm. in diameter respectively. The largest cyst was lined, over the greater part of its wall, by a layer of yellow, lutein tissue about 1 mm. thick. The other cysts contained no lutein. The left ovary was 2·6 × 2·2 × 1·2 cm. and contained no significant structures. The cervix showed medium hypertrophy with protrusion of the first fold through the external os. A finger could be passed through the canal but it was occupied by sticky mucus, transparent and pale yellow in colour. There was none of the uterine exudate in the cervical canal or in the vagina. The vagina, oviducts, fimbriae and bursae appeared normal.

Histology (G. O. Davies).—The endometrium showed changes not unlike those seen in canine "pyometra"; it was considerably thickened and the uterine glands were very numerous although one could hardly apply the term "cystic" to the condition, but the evidence in one or two areas was that the condition was approaching that stage. *C. pyogenes* was isolated in pure culture from the exudate. In one of the cysts in the ovary there was lutein tissue and the others were lined by granulosa cells. Sections of the right Fallopian tube and of the cervix showed no significant change.

My field experience of pyometra has been largely concerned with trichomonas cases but before passing to a review of that condition I wish to refer briefly to puerperal metritis.

Puerperal Metritis. The uterus after parturition affords a favourable medium for the multiplication of bacteria and it is probable that a mild, transient infection develops in many cases. Bosworth, collaborating with me in 1941, isolated *C. pyogenes* from the post-parturient discharges of heifers in which parturition had been normal, but by the time uterine involution was complete the organism had disappeared. The animals conceived again normally without any form of treatment. In cases of retention of the foetal membranes the same organism can generally be found in large numbers. Any condition which retards normal involution favours and prolongs infection, but when the organ reasserts itself and normal function is restored, the bacteria are quickly overcome. I am quite sure you can all recall many cases of prolonged, manipulative delivery in which the animal recovered and bred again without resort to such treatment as irrigation or the sulphonamides: I suggest that we ponder on such cases for they are evidence of the remarkable power of the bovine uterus to overcome infection. I am one who favours non-interference in retention of the foetal membranes in the belief that the risks associated with injury of the endometrium during manipulation are greater than those arising from infection alone. I have watched many cases in which the practice was adopted and while there was inevitably some delay in subsequent conception they did not develop chronic metritis.

TRICHOMONIASIS

Without some reference to this disease our discussion this afternoon would be singularly incomplete, for when investigating infertility the possible presence of this infection must be our foremost consideration. Prominent clinical features of the disease are:—

(*a*) A low conception rate.
(*b*) The frequency of a muco-flocculent vulval discharge.
(*c*) The early abortion of a small foetus complete in its membranes.
(*d*) A high incidence of pyometra.

In addition, irregularities of the oestrous cycle are common in infected herds, but too great moment must not be placed on this point for the condition is also frequent in non-infected herds. The first point to which attention should be drawn is that by no means all females served by an infected bull show clinical signs of infection. In one herd under our control, of 77 cows and heifers exposed to infection by service, 21 per cent. conceived and carried their calves, 49 per cent. failed to conceive but infection was not demonstrable, and from 30 per cent. the parasite was found on microscopical examination. Of the 23 infected animals, five conceived and aborted, four developed pyometra and the remainder failed to conceive. In a second herd of 52 exposed animals, 29 per cent. conceived and carried, 63 per cent., although not pregnant, showed no signs of infection, and eight per cent. were shown to be infected. Of these, three aborted and one developed pyometra. In this herd 27 cows were inseminated, using the semen of an infected bull. Thirteen conceived (I/C ratio 1·07) and are now pregnant from four to nine months, two conceived and aborted and three developed pyometra. The remaining nine showed no sign of infection and some of them are pregnant to insemination using clean semen. Further evidence of variation in susceptibility is afforded by the following: Two heifers (J. 375 and J. 395) were served by a carrier bull on the same day. The first conceived and carried to term and has since shown no sign of infection, whereas the second became infected. Similarly two other heifers in the same herd (J. 287 H and J. 376) were served by another bull at an interval of two days. The first became infected and the second conceived and carried a normal calf.

Apart from abortion and pyometra cases, positive animals have fallen into two clinical groups—the first, in which the uterus was enlarged and flaccid and manipulation provoked a profuse muco-flocculent vulval discharge, and the second, in which no anatomical change could be detected but the parasite was isolated from the mucus discharge of oestrum. It is presumed that the first group were of the type described by Kerr as allergic oedema of the endometrium. They may persist for several months, in fact we have met several cases in which the condition has been present three and a half months after the last service. This is in contrast to abortion and pyometra cases in which the parasite disappears from discharges quickly after the uterus is evacuated.

Abortion. We have found the commonest time for trichomonas abortion to occur to be three to four and a half months after conception. The condition does not appear to be associated with bacterial infection and a striking feature is that the size of the aborted foetus is often much smaller than that which is normal for the duration of gestation. This discrepancy has been described (Kerr and Lamont) as arrested development of the foetus. In one of our cases a 6 cm. foetus was aborted at 104 days, whereas the normal size would have been about 15 cm., and in a second a similar foetus was expelled at 140 days, by which time its body length should have been 30 cm. Instead of describing this as arrested development I would advance the hypothesis that the foetus succumbed at about the ninth week of gestation, a time when placentation is rapidly developing, and was retained in the uterus until the corpus luteum underwent regression some 40 to 80 days later. While we have had no difficulty in finding the parasite in the uterine discharge immediately after abortion, we have failed to find it more than seven days later irrespective of whether or not the animal has been treated. The earliest at which we have had conception occur after abortion has been 67 days.

Pyometra. The significant features of the condition are—the animal has been served some months previously and there has been no return of heat since. There is progressive distension of the uterine cornua by pus but the cervix remains closed. If the animal is frequently examined over a period of several months it is found that one ovary is significantly larger than the other and that it remains unchanged. Evacuation of the pus by means of a catheter passed through the cervix and subsequent irrigation of the uterus by antiseptics, is followed by rapid re-accumulation of pus, whereas the administration of an appropriate dose of stil-

boestrol dipropionate in oil augmented by posterior pituitary extract is followed by evacuation of the uterus, reduction in the size of the larger ovary, the onset of heat and, in many cases, recovery. Gould has suggested that persistence of the corpus luteum was initiated by pregnancy. This would seem a reasonable explanation. The foetus died early and the corpus luteum failed to [illegible]. The endometrium under its influence continued to undergo [illegible]trophic changes and this, in the absence of a normally developing foetus rendered it a favourable medium for invasion by [illegible] which attain it from endogenous sources. Pus is generally abundant, white in colour and of the consistency of "pea soup." No difficulty is experienced in detecting motile trichomonads in it. The bacteria isolated from our cases have been *C. pyogenes* and an unidentified corynebacterium.

It is important that pyometra shall be distinguished from pregnancy. Knowledge of the last service date is a considerable help. At 90 days, the degree of uterine distension is similar to that of pregnancy of the same duration. It may be noticed, however, that the cornua are exceptionally tense. If both are distended to an equal degree it is a further indication of pyometra but often the cornu on the side of the corpus luteum is more distended than the other. It is improbable that a positive diagnosis of pyometra will be made on the rectal findings of a single examination at this stage. On second examination, a month or so later, it will be found that the uterus, although larger, is still exceptionally tense and carried high. Efforts to locate cotyledons or the foetus will be fruitless. We have not noticed any appreciable thickening of the wall of the uterus. The longer the period elapsing since the last service, the more easy diagnosis becomes. When, for instance, examination is made five or six months after service, it is probable that a diagnosis will be made at once. The degree and type of uterine distension is quite different from pregnancy of that stage; tension is greater, the uterus does not sink into the abdomen to the same degree and all evidence of foetus, membranes and cotyledons is absent. Several cases have been met in which there was fremitus of the middle uterine artery. The vagina affords supporting evidence. There is generally an intermittent, muco-flocculent discharge (this discharge arises from the cervix and possibly the vagina and bears no resemblance to the pus which occupies the uterus), in which living trichomonads can readily be demonstrated. In the absence of such discharge at the time of examination, some of the vaginal mucus should be collected manually or by speculum. (The hand and arm should be lubricated with soft paraffin and not soapsuds.) When making this examination the cervix should also be explored for, as Gould has pointed out, in trichomonas-pyometra the cervical mucus is moist and slippery and not tenacious as in pregnancy.

Treatment.—In our early work on trichomoniasis we adopted the accepted form of treatment—irrigation of the uterus. Iodine or iodine with lactic acid were used in the majority but in some mercuric chloride or Metaphen* were employed. In all cases the result was ultimately the same—the animals conceived to artificial insemination. It was observed, on a number of occasions, that living trichomonads were present after iodine irrigation, yet such animals conceived even when no further treatment was applied. A number of heifers were also observed to recover in which no intra-uterine treatment was carried out. These facts led us to believe that in the female recovery was spontaneous and that the essential feature of treatment was to withhold infected service and replace it by artificial insemination, using clean semen. In subsequent outbreaks this has been our procedure. As to whether animals which have been infected and recover possess resistance against reinfection is a subject about which we have insufficient evidence but there are indications that it may possibly be the case. We have not found permanent sterility to be a feature of infection, in fact in one of our outbreaks in which the parasite was found in 23 cows and heifers, 20 of them have since conceived and carried to term, and in the other three other causes to account for infertility were found.

In regard to pyometra, in six cases in which we have used stilboestrol dipropionate followed by posterior pituitary extract, success has been attained. The doses have varied from 25 to 40 mg. of the former and 4 to 6 c.c. of the latter, both administered by intramuscular injection, the pituitary two to four days after the stilboestrol. A copious discharge of pus has commenced in 48 hours and continued for about a week. Oestrum has generally occurred on the sixth day after stilboestrol administration and an examination made at that time has revealed that the ovary which was previously the larger has become small. The conclusion drawn from this finding is that the corpus luteum has regressed. The earliest at which conception has occurred after treatment has been four months. The following case protocols illustrate many of the points which have been brought out in relation to trichomoniasis:—

"Oedema" of the Uterus

J.395.—Friesian. Born 3.8.40.
2.6.42.—Served by carrier bull.
30.9.42.—Examination. Cornua enlarged but not to a degree appropriate to four months' pregnancy. Right about 3 cm. and left 5 cm. broad. Corpus luteum left ovary. Reasonable pressure failed to express corpus luteum. Manipulation of uterus provokes profuse muco-flocculent discharge, positive for *T. foetus*.
6.10.42.—Positive discharge persists. *Vagina* irrigated with iodine.
28.10.42.—Oestrum. Inseminated—failed.
10.1.43.—Oestrum. Inseminated—conceived.
6.10.43.—Calved (female).
11.1.44.—As there had been no sign of heat since calving, corpus luteum expressed from right ovary.
15.1.44.—Oestrum. Inseminated—conceived and carried to term.

Positive Discharge after Irrigation

J.346.—Friesian. Born 2.2.38. Two calves; last calving 27.3.42.
30.5.42 and 6.9.42.—Served by carrier bulls.
16.9.42.—Examination. Uterus turgid, both ovaries flat and irregular; copious vaginal secretion (*T. foetus* not found). Conclusion: has recently ovulated.
28.9.42.—Fully developed corpus luteum in left ovary.
3.10.42.—Uterus infused with iodine.
15.10.42.—Oestrum; mucus positive for *T. foetus*. Inseminated—failed.
25.11.42.—Oestrum. Inseminated—conceived.
3.8.43.—Calved (male).
7.11.43.—Oestrum. Inseminated—conceived and carried to term.
J.350.—Friesian. Born 11.8.38. Two calves; last calving 5.6.42.
26.6.42 and 16.7.42.—Served by carrier bulls.
16.9.42.—Examination. Not pregnant, corpus luteum left ovary. No abnormality detected.
30.9.42.—Oestrum.
3.10.42.—Uterus infused with iodine.
19.10.42.—Oestrum. Vaginal mucus positive for *T. foetus*. Inseminated—failed.
9.11.42.—Oestrum. Inseminated—conceived.
3.7.43.—Sold as a "springer".

Abortion

J.303.—Friesian. Born 1936. Four calves; last calving 25.2.42.
16.6.42.—Served by carrier bull.
28.9.42.—Aborted foetus 6 cm. long complete in membranes. Foetal fluids positive for *T. foetus*.
29.9.42, 3.10.42, 20.10.42.—Uterus infused with iodine.
4.12.42.—Oestrum. Inseminated—conceived.
8.9.43.—Calved (male).
2.1.44.—No heat seen since calving. Corpus luteum expressed from right ovary.
3.1.44.—Heat observed at 7 a.m., inseminated at 3 p.m. Conceived and carried to term.

J.315.—Friesian. Born 9.1.37. Four calves; last calving 11.11.42.
4.1.43.—No heat seen since calving. Corpus luteum expressed from right ovary.
7.1.43.—No sign of heat seen and will not stand for the bull. Examination reveals uterus turgid, both ovaries small and a copious vaginal secretion negative for *T. foetus*. Inseminated using the semen of a carrier bull—conceived.
21.2.43.—Discharge of mucus with hazy opacity, positive for *T. foetus*.
22.2.43.—Aborted. Foetal fluids positive for *T. foetus*.
22.2.43, 6.3.43, 15.3.43.—Uterus infused with Metaphen 0·02 per cent.
7.5.43.—Oestrum. Inseminated—conceived.
7.2.44.—Calved twins (male and female). Assisted delivery, membranes expelled normally.
25.5.44.—Oestrum. Inseminated—conceived.
24.2.45.—Calved (male). Membranes expelled after 24 hours.
1.3.45.—Vaginal discharge positive for acid-fast and diphtheroid bacteria.

Pyometra

J.296.—Friesian. Born 5.12.35. Five calves; last calving 20.4.42.
20.7.42.—Served by a carrier bull and no sign of heat since.
30.9.42.—Examination. Uterine distension appropriate to 70 days' pregnancy. Corpus luteum in left ovary.
28.10.42.—Uterine distension increased but foetus not detected. Corpus luteum persists in left ovary. Vaginal mucus positive for *T. foetus*.
19.11.42.—Uterus tensely distended. No indication of foetus or cotyledons. Pyometra diagnosed. Catheter passed into uterus and about a gallon of "milky" pus evacuated. Pus positive for *T. foetus* and *C. pyogenes*. 250 c.c. of 0·1 per cent. iodine solution injected into uterus.
1.12.42.—Uterus distended as before. Corpus luteum persists in left ovary. Stilboestrol dipropionate 40 mg. given and followed two days later by Hypophysin 6 c.c.
3.12.42.—Profuse vulval discharge commenced and continued for several days.
7.12.42.—Oestrum; cornua erect and each about 5 cm. broad. Left ovary flat and irregular.
7.12.42 and 12.12.42.—Uterus infused with iodine.
6.1.43.—Oestrum.
18.3.43.—Oestrum. Hypertrophy of cervix seen through speculum. Inseminated—failed.
10.4.43.—Oestrum. Inseminated—conceived.
17.1.44.—Calved (female).

J.330 H.—Friesian. Born 16.8.40.
13.5.42 and 25.5.42.—Served by carrier bull. No return of heat.
30.9.42.—Examination. Uterine distension appropriate to pregnancy of four months. Corpus luteum right ovary.
7.12.42.—Cornual distension—right about 12 cm., left 7 cm. Neither foetus nor cotyledons palpated. Middle uterine artery pulsating. Mucoid vulval discharge positive for *T. foetus*. Pyometra diagnosed.
8.12.42.—Stilboestrol 25 mg. followed four days later by Hypophysin 4 c.c.
10.12.42 to 15.12.42.—Copious discharge of pus, positive for *T. foetus* and *C. pyogenes*.
20.1.43.—Oestrum: Cornua turgid and each about 2 cm. broad. Right ovary small and insignificant. Left ovary small and globular and thought to contain a follicle of about 1·5 cm. Inseminated—failed.
13.2.43.—Oestrum. Inseminated—failed.
22.4.43.—Oestrum. Served—conceived.
31.1.44.—Calved (female). Assisted delivery; calf living. Membranes expelled in 12 hours.

In no case have we found the parasite in an animal, previously infected, which has carried a calf to term, and our belief that

* Metaphen—makers' formula: 4-nitro-anhydro-hydroxy-mercuri-ortho-cresol. Contains w/w Hg. 0·125 per cent.

such an animal has recovered is strengthened by the fact that in such animals we have resorted again to service by a clean bull without any sign of infection in the herd recurring.

We have examined five carrier bulls and have found no symptoms during life. There was no balanoposthitis; semen specimens were normal and the animals exhibited none of the reluctance to serve described by Kerr and others. Attempts to treat one bull were unsuccessful. Under epidural anaesthesia, the penis was completely withdrawn and it and the whole of the sheath were vigorously treated with an ointment of Metaphen 0·1 per cent. The animal was then given three months' sexual rest and at the end of that time allowed to serve five maiden heifers. Three conceived; two aborted between three and four months later and the parasite was found, while one is now pregnant five months. In the two which failed to conceive, no sign of infection has been seen. On *post-mortem* examination of the bull, trichomonads were isolated from preputial scrapings but none were found in the urethra, epididymes or accessory glands.

Cervicitis. There are many references in the literature to cervicitis as a cause of infertility in cattle. Some consider it to be a precursor of endometritis. We have not encountered the condition either in the field or the *post-mortem* room. We are, however, very familiar with hypertrophy of the organ with protrusion of the mucus membrane of the first fold through the external os, but in these we find no evidence of active inflammation such as congestion, ulceration or granulation, in fact the condition appears to be usual in multigravid cows. Frequently pregnant specimens come to hand in which the cervix is grossly enlarged. In one of our herds, gross hypertrophy of the organ was seen on speculum examination in 17 of the older cows. Four of these were later found to be sterile from causes other than the cervical hypertrophy and the remainder conceived with a ratio of 2·07. All except one which aborted at seven months, carried their calves to term.

Vaginitis. Vaginitis has not been a conspicuous feature of our investigations. We are familiar with coital exanthema ("bull burn") but have not found it to be a barrier to conception. Moreover, in a few cases of trichomoniasis we have recognised the rasp-like feel of the vagina which has been described, but we do not understand its pathology and cases have conceived without local treatment. In my view the vagina does not play an important part in the causation of infertility.

Acknowledgments

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Discussion

The discussion was opened by Mr. J. N. Bowen, as follows:—

Before attempting to set in motion a discussion on the exposition it has been our privilege to listen to this afternoon, I should like to pay the highest tribute to Professor Wright for affording the members of the North Wales Division this opportunity of hearing his expert observations on a subject which is of such paramount importance to us practitioners and of which our knowledge is so incomplete. The works of Professor Wright on this aspect of veterinary practice are renowned but I feel that this afternoon's paper has surpassed all his previous contributions. The whole problem is one which is fraught with pitfalls, and, if I may say so, delusions, but I think that it can be justly claimed that the paper we have heard this afternoon is one of the most comprehensive and informative up to date.

There are many who consider that the problem of infertility has only reached a prominent position in recent times and it is interesting to learn from Professor Wright that its importance was such as to merit discussion at the International Congress as early as 1909. Since that date our knowledge has increased considerably and the amount of concentrated work which has been done during the past four or five years has done much to clarify our ideas concerning the problem.

To-day there can be little doubt that the presence of trichomoniasis in a herd constitutes the greatest single factor in the incidence of infertility. Whilst it must be readily admitted that our knowledge of this condition is very incomplete I consider that with the promise of increased research and experimental work we shall in the future bring about results which will be a credit to ourselves and a benefit to the farming community. To my mind, one of the most important requirements in this connection, as Professor Wright has intimated, is that we should acquire a more profound knowledge of the physiology of the genital tract and I should like to add that we further require a more detailed conception of its normal and abnormal bacterial flora.

In the few remarks which follow, I propose to deal with Professor Wright's paper in the order of the headings in which he has presented it.

In dealing with the *absence of visible oestrus*, Professor Wright states that this is the most important breeding irregularity. Speaking as a clinician, I cannot readily agree with this view. It is true, of course, that anoestrus and sub-oestrus take up a great part of our time in practice but cases dealt with are usually seasonal, namely, the late autumn and winter. To my mind the *inability to conceive* plays a much more prevalent role in infertility in the field. It should be mentioned here, too, that anoestrus and sub-oestrus are, broadly speaking, conditions of young animals and they frequently right themselves when animals arrive at the age of, and are given facilities to acquire, physical and sexual maturity. It is my experience that the incidence of returning to service is much more common and causes much greater loss. One treats as many of these during the "anoestrous" period of the year as one does anoestrous animals and one continues to do so the whole year round.

Sub-oestrus.—It is my practice to enucleate the corpus luteum in this condition, always taking the precaution of warning the farmer of the slight risk involved. (I have had one death over a period of twelve years, during which time I must have enucleated very many thousands.) I would like to ask Professor Wright if he considers treatment for this condition with stilboestrol justified. For my own part I am chary about its use, fearing that it might result in multiple ovulation and possibly cystic ovaries. I have encountered little difficulty in expressing the majority of corpora lutea but I find it necessary on some occasions to express the corpus luteum with the right hand in the vagina, fixing the ovary in the required position by means of the left hand in the rectum.

Anoestrus.—I have no remarks under this heading except to endorse most heartily Professor Wright's reference to parasitism as a contributory factor in young animals. I have held this view for a number of years and to my mind the condition cannot be over-emphasised. In this connection the obvious increase in the incidence in recent times can, I think, fairly be put down to malnutrition and over-stocking brought about by war-time conditions. Over-stocking is an important factor because it not only leads to less available food but also to a considerable increase in the intake of infective larvae and thus establishes what might be termed a vicious circle.

Stilboestrol.—This product has proved unsatisfactory in my hands in the treatment of true anoestrus, *i.e.*, where ovaries are small, hard and smooth, and I have long since ceased to use it for this condition.

Pregnant mare's serum.—I have used some 30 doses of this product and have not in a single instance obtained a visible oestrus, but in the few which were subsequently examined ovulation had occurred in all within three days of *intravenous* injection. In one or two instances it occurred in 24 hours. In none of the cases, however, were there obvious signs of oestrus except for a slight filling of the vulva. 1,500 units were used. I have not used this product during the last two years.

Cystic Ovaries. I am familiar with the condition described by Professor Wright under this heading. Generally speaking, cystic ovaries are not as common as one is led to believe from the literature but like Professor Wright I have encountered several where anoestrus, and not nymphomania, has been the rule. In some cases, however, the period of anoestrus has been followed by incurable nymphomania. It is interesting to note that Professor Wright has found on *post-mortem* examination a varying

degree of luteinisation and this fact makes one wonder whether in effect one is dealing with cases of a cystic corpus luteum. The existence of this latter condition is by no means proved but theoretically there is, I think, a fairly strong case for this being so.

In true nymphomania the cyst is follicular in origin, *i.e.*, it results from failure or imperfect rupture of the follicle. Consequent on this there is a persistent high oestrin concentration resulting in excessive heat. To my mind it is not unreasonable to assume that just as follicles "go wrong" so also might corpora lutea, and if this happens the persistent inhibiting effect of the progesterone thus produced would render the ovary insensitive to follicular stimulating hormone, with the resulting anoestrous phase. I would be interested to know if Professor Wright has any further observations to make on this point.

Before leaving the ovaries I would like to hear from Professor Wright his views on another aspect of anoestrus. I refer to that condition which I will describe, for lack of a better term, as "enlarged fleshy ovaries." Like the preceding condition it is, in my experience, found in mature well nourished animals usually from third calvers upwards which have been housed over long periods, *e.g.*, winter. The affected animals, in nearly all cases I have encountered, have a reputation for a long lactation period. On rectal examination *both* ovaries are found to be enlarged, soft and have a corrugated feel. Presumably the latter is due to the super-abundance of scar tissue. There is no intense abnormality, and a high percentage of animals so affected return to oestrus in a relatively short time with the advent of abundant exercise and fresh green fodder. All other lines of treatment in my hands for this condition have failed miserably. No doubt other practitioners will be able to enlarge on this problem.

Frequent Return to Service

Failure to Ovulate with Luteinisation of Follicle.—It is obvious that little can be said by a practitioner on this subject. There is little doubt that the condition does exist but as Professor Wright has pointed out, it is practically impossible to diagnose clinically.

Ovaral Bursal Adhesions.—I have no comment to make under this heading based on *post-mortem* examination. It is interesting and perhaps surprising to hear Professor Wright describe this as the most common abnormality of the genitalia. My experience certainly does not bear this out and I think the obvious explanation for this is the fact that Professor Wright has obtained his *post-mortem* material from the commercial flying herds of Cheshire and Lancashire, whereas mine has been obtained from the self-contained and relatively tubercle-free semi-upland herds. To my mind, the clinical significance of the condition has been over-emphasised and is comparable in this respect to salpingitis. He is a brave man indeed who will base his prognosis of an infertile animal on the fact that he was unable to introduce his fingers into the ovarian bursa, or that in doing so he encountered adhesions. Similarly, under "salpingitis," it is often amazing the variation in size encountered in the salpinx of animals which have perfect breeding records. One is led to the conclusion that thickness of Fallopian tubes is of little significance in diagnosis and prognosis and extreme caution should always be exercised in assessing their importance. There is one practical suggestion I would like to make where one is reasonably certain that bursal adhesions and/or salpingitis is unilateral and that is that such an animal should be served when the ovum is produced in the unaffected and normal ovary. Take, for example, a cow affected with one or both of these conditions in the right ovary which, on examination, is found to have a corpus luteum in the left ovary. If this corpus luteum is enucleated at the time of examination it can be assumed that the animal would normally be in oestrus within six days with follicular development in the ovary of the diseased right side. Mating the animal at this oestrus would be fruitless and it would be much more reasonable to advise that the animal be withheld at this oestrus, but that it is imperative that she be served at the subsequent oestrus when she ovulates on the sound ovary. Should this oestrus be missed it would be necessary to allow the next heat to pass, as ovulation would again be on the unsound ovary. In any case such an animal should be served on two *consecutive* heats.

Delayed Ovulation. I feel sure that the majority of practitioners are in full accord with Professor Wright's views on this condition. From a practical point of view it may be stated that although the condition *may* exist it is of relatively little importance.

Infective Diseases of Genital Organs. Under this heading Professor Wright has wisely emphasised the importance of always bearing in mind the possibility of tubercle infection. I would be glad if he could tell us of his experiences of the effect of irrigation with "lugol" in an animal suffering from tuberculous metritis. I can recall two such cases, both of which occurred in herds with a very clean tuberculosis record. I was unable to detect tubercle on clinical examination, yet both animals were taken under the Tuberculosis Order within six weeks of "lugolising." To my mind, the rapidity with which the emaciation progressed precludes the probability of infection being introduced by the catheter and this was borne out by the widespread lesions found on *post-mortem* examination. One wonders, therefore, if "lugolisation" of a tuberculous uterus does not act as a terrific stimulus and in a few cases cause rapid and widespread dissemination of the disease. I would be glad to learn whether Professor Wright has had similar experiences.

With reference to salpingitis I have great misgivings as to my ability to assess the clinical importance of this condition and that of bursal adhesions in relation to infertility. My experience goes back over many years, during which I have encountered more cases than I care to recall of uni- and bi-lateral thickenings of the salpinx, sometimes accompanied by adhesions where infertility has not resulted. The most I would be prepared to claim from clinical examinations of these conditions is that they help one to give a guarded prognosis, but I would submit that it would be rash and foolish to dogmatise on the subject.

Under the heading Metritis there is no doubt in my mind that from our experience of this condition we have reached the stage where we must modify fairly drastically the accepted views of past years. To cite one example, let us take so-called endo-metritis of the first degree which has been claimed to cause between 70 per cent. and 80 per cent. of infertility. I suppose there is no one present who has not had occasion to doubt the veracity of this statement. Indeed, in my experience, the truth is that these 70 to 80 per cent. constitute an infertility of obscure origin where no amount of clinical endeavour throws real light on the animal's inability to breed. Fortunately, however, these animals respond to irrigation with lugol—it is a moot question whether the response is due to the stimulating effect of the iodine and I have often wondered whether the good results obtained are not in fact due to injecting fluid into the uterus under varying pressure and thus bringing about a condition of pseudo-oestrus in the uterus—or to put it another way, placing the uterus in an "oestrogenic" state. I have no evidence with which to substantiate this view, beyond that of Hignett who, it will be remembered, some years ago claimed to have brought about oestrus in a fair number of *anoestrous* maiden heifers by uterine irrigation, but I consider that experiments might well be carried out on these lines with considerable advantage. Again, the beneficial effects which follow injections of stilboestrol in the treatment of pyometra can, I think, be justifiably put down to the same cause in so far that the uterus is rendered sensitive to the action of oxytocin.

Puerperal Metritis. In my opinion this condition plays a predominant part in the cause of infertility, and is probably secondary only to trichomoniasis. To my mind it may well be that even in cases of specific disease, like trichomoniasis, and certainly in abortion, the infertility factor is due to secondary infection as a direct result of a retarded rate of involution of the uterus.

Further evidence in support of this view can be found in the high incidence of infertility encountered in animals which are kept on the margin of starvation in the last stages of pregnancy and consequently calve down in poor bodily condition. On examination it is commonly found that the pregnant horn is double and even treble the size of the non-pregnant one even as late as six or eight weeks after parturition. I would be interested to learn if anyone present has ever subjected such animals to treatment with stilboestrol and pituitary in order to hasten involution. Certainly "lugolising" such animals a month after parturition tends to cut down the period of infertility.

With reference to Trichomoniasis we should, I think, be grateful to Professor Wright for pointing out that an infected bull does not necessarily mean an infected or non-pregnant animal—the figures he gives are most interesting and are worth reiterating: 77 cows and heifers exposed to infection by service, 21 per cent. conceived and carried their calves, 49 per cent. failed to conceive but infection was not demonstrated. The parasite was discovered in 30 per cent.

I would also like Professor Wright to give us his views as to whether it is advisable to withhold for a time service of any kind from infected cattle after they have been treated. I have long suspected that coitus, even when a *clean* bull is used, incites a catarrhal condition of the endometrium and it is my practice at present to advise that the bull should be withheld from treated animals until the third oestrus after treatment has been completed.

I am in perfect accord with Professor Wright's views on the subject of Pyometra. I would suggest that the question of whether an early abortion occurs, or pyometra develops, or even the presence of a mummified foetus carried over-term (I have seen four of the latter cases in one trichomonas-infected herd) depends upon at what stage the corpus luteum decides to regress, complicated, of course, in the case of pyometra by the introduction of infection. I cannot help feeling that Professor Wright has somewhat exag-

gerated the difficulty of the diagnosis of pyometra—the tenseness of the uterine horn, with the lack of fluidity which is found in the pregnant horn, is surely sufficient to make one suspicious of pyometra even as early as nine to twelve weeks. To leave such an animal for as long a period as a month is unjustifiable—one can and ought to be able, in the vast majority of cases, to diagnose with certainty the presence of this condition at a second examination carried out within 14 days. The advantages of early diagnosis are important because expression of the corpus luteum gives the best results, and if the case is allowed to run on it may be impossible to reach the ovary. Here reference might also be made to fremitus of the uterine artery—in my experience fremitus is usually entirely absent in cases of pyometra and mummified foetus—I have encountered some cases where faint fremitus has been palpated, but this has only been possible after varying the amount of tension placed on the artery and has in no way resembled that vigorous tremitus encountered in a "live" pregnancy of a similar duration.

CERVICITIS AND VAGINITIS. Constant use of the speculum cannot but lead one to the conclusion that the importance of these conditions has, in the past, been wrongly assessed. One is continually meeting cases where the cervix, to outward appearance, indicates the presence of gross infection, and yet the affected animal breeds, breeding normally and regularly. I readily call to mind one such case which, on the initial examination, presented a picture of the cervix being inverted and covered with a purulent discharge. It was considered too gross to irrigate the uterus and the cervix was painted with 1 per cent. iodine. The animal was, however, irrigated a week later. This animal had been served one month before the initial examination and despite the condition of the cervix and the manual interference she was subjected to, she calved down normally to that service.

Finally, let us readily admit our shortcomings in dealing with this complex subject. We should be, and are, grateful to men like Professor Wright who devote so much of their time in trying to grapple with and solve some of our problems. Under the stress and strain of present war-time conditions the life of the general practitioner has become too hectic for him to collect data from each individual case which he sees, but it should be remembered that we must always try to retain a certain measure of the research mind and in this connection I am reminded of some lines by W. H. Davies which are rather appropriate:—

> "What *is* this life *if*, full of care, we have no time to stand and stare?"

The Reply

Professor WRIGHT: I am delighted that my remarks have provoked such an excellent discussion. Like myself, Mr. Bowen does not regard rectal examination as completely reliable for the detection of many of the changes which may occur in the genital organs during infertility. In his experience, absence of visible heat has not been as common as frequent return to service. In this connection I would only say that the majority of herds with which we deal are Friesians and Ayrshires in which the disposal of non-pregnant animals to the butcher assumes more serious proportions than it does with shorthorns. Mr. Bowen's views on the value of stilboestrol and of pregnant mare's serum in the treatment of anoestrum and subœstrum coincide with my own, in fact I think the general view of the meeting is that they are by no means the complete answer. Mr. Bowen questioned me regarding abnormalities of the ovaries in relation to variations in the œstrous cycle. We have frequently found ovaries containing multiple cysts to be associated with prolonged absence of heat and on *post-mortem* examination of such cases a variable quantity of lutein tissue has been found lining one or other of the cysts. We consider it probable that the persistence of these luteinised cells is the cause of the absence of heat but its quantity does not appear to be sufficient to control excess follicle development. Such cases may resolve spontaneously, but it is possible that such an animal may later become nymphomaniac. We have observed displacement of the sacrum to occur in cases of cystic ovaries with heat absence. At the same time we have seen spontaneous nymphomania and nymphomania provoked by the use of stilboestrol, in which the ovaries on rectal examination were indistinguishable from those previously described, but on *post-mortem* examination of such no sign of lutein tissue has been seen. But as I pointed out in my paper, there is another cystic condition found in the ovary which is associated with regular heat cycles—the so-called cystic corpus luteum. To this we would prefer to apply the description —failure to ovulate with luteinisation of the follicle. It differs from the previous conditions in that there is one cyst only and the whole of its wall is lined by a layer of lutein tissue of variable thickness. The surface of the ovary shows no evidence of ovulation having occurred but in its substance are found regressing remnants of previous corpora lutea of œstrum. We have obtained such a specimen from a cow which was in œstrum nine days prior to slaughter. I am familiar with the large, fleshy ovaries to which Mr. Bowen referred. Their size in such that the presence of a fully developed corpus luteum in one of them is not readily detected in life. On *post-mortem* examination it is found that this excess size is made up of a large number of visible follicles up to 0·5 cm. in diameter. Irregularity of the surface may be caused by these follicles, but it must be remembered that in multiparous cows irregularity may result from the corpora albicantes of previous pregnancies. We have no evidence that such ovaries are pathological.

The cause of ovaro-bursal adhesions in the absence of tuberculosis is not known. It is of interest to note that in those cases in which the adhesions are string-like, it can be seen that they are attached to the scars of old corpora lutea and I have, on a previous occasion, speculated that they might be a physiological hazard. This explanation, however, does not account for the fibrosis and shrinkage which often occurs in the bursal wall. It has been suggested that such agents as Brucella infection or retention of the foetal membranes may play a part. As I have already said, I am unable to detect early changes in the tubes on rectal examination, in fact I think that they are frequently confused with the terminations of the cornua.

Ovulation is not necessarily alternate: it is frequently found to have occurred from the same ovary on as many as three successive occasions, particularly the right. Mr. Bowen regards puerperal metritis as being of much greater consequence in the causation of sterility than I do. He is also a little scornful of my hesitancy in diagnosing early cases of pyometra. I can only reply that I approach the operation of emptying a distended uterus with some trepidation, and I wish to be quite certain what I am dealing with before I attempt it. I know that on paper it is quite easy to distinguish a 90-day pregnancy from pyometra of a similar period, but in the cow-shed it is not always so easy. I have in mind those individuals, fat shorthorns particularly, in which consequent on tightness of the anus almost paralysing one's arm and continuous peristalsis, it is impossible to do more than palpate the outline of the uterus. I recall such a case in which I was assured that the animal had not been served yet had been anoestrus since her last calving four months before. After fiddling for half an hour or so I failed to pass the catheter through the cervix. It was just as well that I did, for she delivered a heifer calf six months later.

Mr. O'Neill was the first to ask the question that has since been reiterated by the President and others—what procedure is advised in a trichomonas-infected herd? I am afraid it is a long story. It will depend primarily on the size of the herd and the proportion of cows and heifers which have been exposed to infection. Let us take the medium-sized self-contained herd in which it is probable that infection has existed for four to six months. Our practice is, first, to examine every adult female in the herd, and divide them into the following groups:—

1. Those positively pregnant.
2. Those possibly pregnant—to be re-examined.
3. Recently calved animals which have not been served since.
4. Recent abortions.
5. Those returning to service in which no abnormality is detected.
6. Those which have been served and have since shown no sign of heat

but are not pregnant:—

(*a*) No abnormality detected.
(*b*) Distension of the uterus due to "oedema".
(*c*) Pyometra.

One next proceeds to an examination of vaginal mucus. Trichinomonads are most likely to be found in cases of (*a*) pyometra, (*b*) uterine "oedema", (*c*) impending abortion and (*d*) recent abortion (up to five days). Having established the presence of the infection by finding motile parasites under the microscope. the non-pregnant females are divided into two groups:—

(*a*) Non-infected maiden heifers and recently calved cows not served since. (Any cows about which there is a doubt as regards service and there are generally several, must be included in (*b*).)

(*b*) Those actually or potentially infected by service.

All the bulls being used on the farm should be regarded as carriers even when the service records would appear to indicate that one or other has not been exposed to infection.

The most certain and speedy way to overcome the disease is to replace natural service by artificial insemination using "clean" semen. One of my colleagues and I demonstrate this in a paper shortly to be published elsewhere. This, however, is easier said than done, for if the insemination is to be performed by a practitioner, the time involved would render it uneconomical. Practitioners with whom we consult realise this and have requested us to instruct their clients in the procedure so that they can carry it out themselves, and this we have done. But it may properly be asked, are there alternatives? Artificial insemination is a cumbersome and time-absorbing matter for the farmer. Furthermore, his infected bull or bulls may be very valuable animals whose progeny he is most anxious to obtain, and thus the advice that such a bull should be destroyed, out of hand, may not be acceptable. As Mr. Mahmoud has said, we have found that the use of carrier bull semen when used by insemination on females already exposed to infection by service, was followed by a high conception rate, whereas such semen used in non-exposed animals was followed by a low conception and a high infection rate. I would stress that this finding was based on insemination and not on service by carrier bulls. At the same time, when the carrier bull is a valuable one, you might consider it worth while to allow him to continue serving cows already exposed to infection and obtain a clean bull for the service of non-exposed heifers and recently calved cows. Should the groups become mixed, confusion will become worse confounded.

We do not adopt any intra-uterine treatment. The only cases which receive treatment are those of pyometra and others in which there is absence of heat. Such treatment is directed at the ovaries rather than the uterus.

Mr. O'Neill also was the first to refer to my statement that I advocated non-interference in cases of retention of the foetal membranes. Most speakers have expressed surprise at this but Mr. Adamson has supported my contention, in fact the procedure adopted by him is exactly the one I advise. When as a young veterinary surgeon I commenced to think for myself, it struck me as remarkable that retained foetal membranes in the cow could be ignored for three or four days, by which time they had become a putrid, stinking mass, yet it was imperative that after this time they should be removed. As a junior assistant in practice when instructed to remove them, I frequently found firmly adherent cotyledons in the apex of the cornu beyond the reach of my hand. What was I to do? I regret to say that in many instances I tore away those parts already detached and left the remainder *in situ*. Yet to my astonishment the cows appeared to suffer no additional harm therefrom and in due course conceived again. On the contrary, I well recall cases in which separation of the cotyledons necessitated vigorous manipulation in which the animal became severely ill after the interference. It was Mr Parry, I think, who said that he had had two cows die from retention of the membranes. I would ask him two questions; the first, is he sure that it was retention alone which caused the animal's death, and the second, has he ever had a cow die from manipulative interference? But the practice of non-removal is by no means a new one. In Lincolnshire, where salt has so long been popular, the practice of placing a little bag of sodium chloride in the uterus was adopted, while elsewhere pessaries containing a variety of so-called antiseptics were used; all apparently with the same results. During recent years I have closely watched many cases of retention following a normal calving, in which no intra-uterine interference was applied. If the membranes had not already dropped some eight or nine days later, a little simple traction on the parts in the vagina generally served to remove them. I have found that animals so treated did not suffer harm that could be ascribed to the non-interference nor did they become permanently sterile.

Mr. Wyse asked how long immunity to *T. foetus* infection lasted—I don't know. Mr. Sutherland asked if I thought irrigation of the uterus with iodine did harm—I have seen none that I could ascribe to it.

Mr. Lewis asked what were the causes of retention of the membranes. As a young man I regarded *Brucella abortus* infection as the common cause, but I remember that Williams, of Cornell, was amongst the first to cast doubt on this belief. He considered it was due to some other infection of the uterus during pregnancy, possibly streptococcal. For my own part I do not think that infection is an important factor. It is quite certain that the condition occurs frequently in cows that are free from Brucella infection and I have noticed no marked mortality in the calves born from affected animals. I believe an important cause to be failure of the uterus to continue to contract after delivery of the foetus. We have no way of measuring the effort exerted by the uterus during the second stage of labour and it is possible that it has in measure become exhausted and that a temporary inertia supervenes.

Finally, I will answer the question regarding the bull as a factor in bovine sterility. I had not intended to introduce the bull into the discussion for the cow is complex enough. It was Lagerlof who taught us that between the limits of high fertility and complete sterility, there were many gradations of reduced fertility, a factor which could be responsible for considerable breeding losses. So far, the work of my colleague G. H. Arthur has not confirmed this view. The introduction of artificial insemination has given us a means whereby semen can be biologically assayed, for it is possible to prove the fertility (if not the infertility) of the specimen of semen one is evaluating by laboratory methods. We have had many surprises both as regards the count and the proportion of abnormal spermatozoa in fertile specimens. Very much more work will have to be done on these lines before laboratory evaluations of semen samples can be accepted as accurate in regard to reduced fertility.

CLINICAL COMMUNICATION

Caesarean Section in the Heifer and Cow

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Caesarean section in the cow is one of the simplest, most useful, and most highly successful major operations a veterinary surgeon can attempt.

The simplicity of the operation is due to:—

1. Easily applied anaesthesia.
2. Straightforward choice of site.
3. Ready accessibility of uterus.
4. Absence of serious sequelae in most instances. Grave and fatal sequelae may occur, *e.g.*, "shock," which, when it occurs, almost invariably proves fatal; "peritonitis"—this is rapidly localised by adhesions, and only in few cases does it become generalised; "hernia," with danger of bowel strangulation—this is due to faulty suturing of the peritoneum. In the experience of the author, however, these serious sequelae are not commonly encountered, and if the operation is performed with the maximum of care, prospects of success are very bright.

The success of the operation is due to:—

1. The amazing resistance to infection of the subject, and of the subject's peritoneum.
2. The almost complete lack of haemorrhage.
3. The rapid contraction of the uterus immediately after the removal of the calf.
4. The rapid healing of the uterus, peritoneum and abdominal musculature.

The usefulness of the operation to the veterinary profession cannot be too strongly emphasised, because, not only can it be used to take the veterinary surgeon "out of a tight corner" in cases of difficult parturition, but it can, by its intelligent application, be the means of saving thousands of heifers' and cows' lives, which would normally be lost.

Lactation and future breeding potentialities may be seriously interfered with. In 20 cases operated on at or near the full gestation time, however, only one heifer has failed to come to her milk. Three heifers and two cows operated on twelve months ago are now close at calving, whilst approximately 90 per cent. of other more recent Caesarean section cases appear to be holding to the bull. It is the opinion of the author that prognosis, regarding lactation and future breeding, should be optimistic, but careful records are being kept and the results may be published after a suitable elapse of time.

Indications

1. Heifers which have been prematurely mated and are calving down at 14 months to two years of age. In the vast majority of these cases the heifers have an immature pelvis. In most cases also the growth of the heifer's body has been sacrificed for the growth of the calf: consequently, delivery of the calf by the pelvic route nearly always necessitates barbarous traction by block and tackle or by a large number of men, which traction almost invariably kills, or cripples, the heifer, by causing shock, broken pelvis, irreparable laceration or rupture of the uterus or uterine cervix.

2. Heifers or cows with congenital or acquired abnormalities. The chief of these is the cirrhotic os cervix. Fortunately this type of abnormality is not common. There are other abnormalities which may be encountered, *e.g.*, malformation of pelvis and thick fibrous bands in the anterior vagina.

3. The third indication is by far the most important and holds out the greatest prospects of an ever-increasing saving in lives. The typical case, in which the operation is indicated, is encountered in the late winter or early spring. A heifer or a cow carrying a large calf goes down and is unable to get up again. The animal appears perfectly normal otherwise; she eats, chews her cud, has normal temperature, good pulse and normal respirations. She may or may not be in poor condition, but in most cases no indication of disease is found. Hitherto this type of case has been variously diagnosed as paraplegia; debility due to a hard winter; paralysis due to mineral deficiency or a bad liver; hypomagnesaemia, etc., and it has been treated with calcium and magnesium, nux. vom., potassium iodide, etc., but in very few cases has treatment proved successful. Unless an animal, so affected, manages to calve within a few days of her going down, she never gets up at all, and invariably finishes up in the knacker yard. The author has operated on several cases similar to the above within the last four months; in each case the animal has been anything from a fortnight to two months off calving. The success in these cases has been most encouraging, and in all cases so far the subject has been on her feet within 72 hours of operation.

It has been suggested that, in cases such as the above, normal parturition can be induced by the use of "stilboestrol." Whilst this therapy may be successful on occasion, the time lost in waiting for the "stilboestrol" to act greatly jeopardises the animal's chance of complete recovery.

Method of Restraint.—Where the animal can walk she is taken into a roomy loose box or a covered straw yard. She is held by a halter or by bull-dogs and is cast by Reuff's method. The legs are not secured. Where the animal is unable to rise, only bull-dogs are required for control.

Anaesthesia

1. *Chloral hydrate intravenously.*—This is by far the best anaesthetic from the point of view of the operator. It is safe, easily administered, rapid in its action, and its effects quickly wear off. It also renders the subject completely immobile for a duration of at least one and a half hours. The dose required may be anything from 1 oz. in small heifers to 3 oz. in large cows. One objection to the use of this anaesthetic is that it nearly always kills the calf.

2. *Chloroform.*—This can be used where a live calf is desired. The anaesthesia produced is quite satisfactory. The chloroform is administered, using a Cox's inhalation mask, and the dose ranges from ½ oz. to 2 oz. The great disadvantage of this method, however, is that an assistant is required to give and to control the anaesthesia.

Whilst, in most cases, the life of the calf is of secondary importance to the life of the cow, it gives great satisfaction to have a live calf as well as a live cow. The author has been fortunate enough to deliver a good number of live calves by the Caesarean route. One pedigree bull calf thus delivered was sold for 30 guineas the morning after the operation.

Materials required for operation.—White sterile operating overall; hair clippers and sharp razor; two sterile enamel trays; sterile swabs, 8 oz. dettol, and one jar of velufax or other similar protective ointment (the latter to take the place of rubber gloves); sharp scalpel, needle forceps, two pairs of artery forceps, scissors, two large half curved and three medium curved suture needles; six ampoules No. 3 sterile chromic catgut, six lengths of boiled No. 17 silk, and 4 oz. sterilised sulphanilamide.

Technique of Operation

The animal is cast and anaesthetised as described above. She is now propped up by means of baled straw, on her brisket, with the right hind leg and right side uppermost and in an advantageous position as regards maximum daylight or artificial light. A high powered, movable electric light held by an assistant is a great help to the operator.

The site is now clipped and shaved; the site chosen is an area extending from the lumbar vertebral processes of the right side, downwards, a distance of approximately 18 inches and approximately eight inches across. An ordinary safety razor with a new blade is ideal for shaving purposes. The whole area is washed with warm water and soap and painted with pure dettol.

The operator now dons his sterile overall, washes his hands and arms, first with warm water and soap, then with pure dettol. The hands and arms are now smeared with velufax. An incision is made, commencing about three inches from the lumbar vertebral processes and extending downwards for at least 12 inches; the incision should be made parallel to, and approximately four inches from, the last rib. The incision should be made confidently, through the skin, muscles and peritoneum. Quite often, on opening the peritoneum, a considerable quantity of bowel may extrude through the wound. This bowel may be placed on a sterile enamel tray, but it is much better to replace the bowel immediately with both hands, simultaneously drawing the uterus up to the operation wound, thereby occluding the opening and preventing further bowel prolapse. In most cases the mesentery has to be incised to allow free access to the uterus.

A straight incision about ten inches long is now made in the uterus. The hind legs of the calf are grasped, straightened, and the calf is gently drawn through the wound opening by an assistant. It is very important that traction applied to the calf should be gentle, otherwise the uterus may tear very easily. If the calf is not coming with gentle traction, enlarge the uterine incision about one inch at either or both ends. In most cases, however, the ten-inch incision is quite sufficient to permit easy passage of an average-sized calf.

It is universally recommended that the afterbirth should be removed in Caesarean section. The author has found that if the afterbirth is not taken, a better job can be made of suturing the uterus. This is due to the afterbirth preventing a too rapid contraction of the musculature. In the majority of cases the afterbirth will be expelled *per vaginam* within 48 hours of the operation being completed.

The incision in the uterus is now closed by two rows of Czerny-Lembert sutures, using the No. 3 chromic catgut. The 4 oz. of sterilised sulphanilamide is now lightly massaged over the exposed uterine surface, the peritoneum, and the cut surfaces of the muscle. The peritoneal wound is carefully closed by a continuous catgut suture. The muscles are drawn together by a row of interrupted

ABSTRACTS

[The Nutritional Requirements of the Dog. Michaud, L., and Elvehjem, C. A. (1944.) *Nutr. Abstr. Rev.* **13**. 323-331.]

This is a valuable review by two workers in the Department of Biochemistry, the University of Wisconsin. Elvehjem is well known for his many contributions to the subject. There are 87 references, including some to work not yet published.

The quantitative dietary requirements of the dog have received serious attention only during the past decade and interest has been aroused largely by the development of commercial dog foods and the availability of synthetic vitamins.

Calorie requirement.—A dog weighing 13·5 kg. has a basal requirement of 48 calories per kg. daily and a total energy requirement of 80 calories per kg. Since caloric needs are more directly related to surface area than to body weight, small animals require more food than large ones. During growth, pregnancy and lactation the caloric requirements are increased. Pups need about twice as much food as adult dogs, *e.g.*, 282 calories per kg. daily for pups weighing 1 kg., and 180 calories per kg. for pups weighing 5 kg. The individual response of an animal affords the most valuable guide to its needs, provided that all essential nutrients are supplied in adequate amounts.

Carbohydrate.—Dogs will thrive on a wide range of carbohydrate intake if the other constituents supply essential factors. The authors have found that diets containing 66 per cent. sucrose are satisfactory for maintenance and growth and other workers have used percentages of sugar varying from 12·5 to 70. Starch is well tolerated, contrary to popular opinion, and potatoes are well utilised.

Fat.—A small amount of fat is necessary to furnish the essential fatty acids and the fat soluble vitamins. Most experimental rations contain 5 to 11 per cent. of fat but even 40 per cent. can be given if choline and protein are present in quantities sufficient to prevent fatty cirrhosis of the liver. There is evidence that high fat rations produce a finer and more brilliant coat and low fat diets tend to produce coarse, dry hair.

Protein.—Meat supplies important factors in addition to protein. As a source of protein the value of meat lies in the amino acids liberated in digestion. The amino acids necessary are tryptophane, lysine, histidine, phenylalanine, leucine, *iso*leucine, threonine, methionine, valine, and probably arginine and glycine (ability to synthesise glycine for detoxication purposes seems to be limited). A diet very low in protein (1·5 per cent.) favours development of gastric and duodenal ulcers. Owing to war-time difficulties commercial dog foods in the U.S.A. must not contain more than 24 per cent. protein, including not more than 8 per cent. from animal sources. The authors have found that pups benefit from addition of casein to such commercial dog foods. Symptoms of "hysteria" were produced by a diet of wheat and meat scraps subjected to dry heat and also by some commercial preparations of wheat gluten. When the gluten was removed from the diet the animal gradually recovered. The cause is probably a toxic factor rather than a deficiency. Experimental work suggests that vegetable protein is as useful as meat protein and both dogs and foxes grow well and have excellent coats on diets containing only vegetable protein. Under practical conditions, however, it is easier to supply adequate protein and other essentials if animal products are used.

Vitamin A.—Vitamin A deficiency may cause ophthalmia, bone changes and deafness, nervous symptoms, and skin lesions. It is probable that 20 μg. vitamin A per kg. is sufficient for growing dogs and the carotene requirement is estimated at two to three times this amount.

Vitamin D.—The vitamin D needed varies according to the Ca : P ratio. The greater the excess of Ca over P the higher the vitamin D requirement. With a Ca : P ratio of 1·2 : 1 a dose of 10 to 20 I.U. vitamin D per kg. provides an adequate daily supply.

Vitamin E.—Symptoms of deficiency of this vitamin have been produced experimentally and the requirement of dogs has been estimated as 1 mg. per α tocopherol daily per kg. body weight.

Vitamin C.—Although some workers have referred to scurvy in the dog there is little evidence that the condition occurs in the absence of deficiency of other factors. Large numbers of dogs used for experimental purposes are reared on synthetic diets containing no vitamin C but complete in other respects.

Vitamin B_1 (Thiamine, Aneurin).—Patton (1939) has claimed that "fright disease" (hysteria) can be produced by a deficiency of this vitamin, the animals being fed autoclaved commercial dog foods. Elvehjem and others have, however, produced the same symptoms in dogs on diets containing adequate amounts of vitamin B_1. Requirements of the vitamin for maintenance are probably 10 μg. per kg., and twice this level for growing animals.

Riboflavin.—The symptoms observed in experimental riboflavin deficiency (chronic) include nervous derangement, vascularisation of the cornea, skin lesions, and intestinal ulceration. It is probable that riboflavin is essential for the normal process of red cell formation. Repeated bleeding of dogs causes a microcytic hypochromic anaemia when the animals are on a diet deficient in riboflavin. In animals supplied with the vitamin the anaemia is of the normocytic hypochromic type. It appears that young animals require more riboflavin per kg. body weight than adults, 15 and 30 μg. respectively being the requirements indicated by the most recent work.

Nicotinic acid.—To prevent blacktongue the nicotinic acid level in the diet must be at least 0·12 mg. per kg. body weight. A low level of the vitamin may possibly affect intestinal synthesis of unknown factors as well as the reserve of nicotinic acid in the tissues.

Vitamin B_6 (Pyridoxine).—A level of 10 μg. per kg. body weight probably suffices for maintenance. Deficiency of this vitamin causes a microcytic hypochromic anaemia.

Pantothenic acid.—Little work has been carried out on this factor but sufficient evidence has been obtained to show that it is essential.

Choline.—Work on pancreatectomised dogs showed that choline is necessary for proper fat metabolism. Some dogs seem able to synthesise sufficient choline to make it impossible to produce signs of deficiency but the probable requirement in most animals is 10 to 50 mg. per kg. daily.

Minerals.—The dog requires Ca, P, Na, Cl, K, Mg, Fe, Cu and I, and probably Mn, Co and Zn. The optimal Ca : P ratio appears to be 1·2 : 1 when both minerals are present in assimilable form. Excess of Ca increases the vitamin D requirement and a great excess of Ca may make it almost impossible to prevent the development of rickets. Iron is necessary for haemoglobin formation and diets consisting solely of milk result in anaemia in growing animals. Copper is also essential for haemopoiesis and there is some evidence which suggests that Co may also be of value. It is suggested that a level of 0·4 mg. Fe and 0·06 mg. Cu per kg. body weight is more than sufficient for growth and maintenance.

Conclusion.—Dogs fed meat diets will probably grow and develop normally if sufficient quantities of internal organs are supplied to provide extra amounts of vitamin A and riboflavin, and if bones are included to supply additional Ca. Diets consisting largely of milk will require supplements of Fe, Cu, Mn and vitamin D. Addition of these supplements to a diet of whole raw milk has enabled dogs to be bred through several generations. Diets consisting mainly of cereals require supplements of protein, riboflavin, nicotinic acid and Ca : suitable sources of these supplements are meat, bone meal or calcium salts, and yeast or liver.

E. G. W.

* * * * *

[Canine Nutrition, with Special Reference to Reduced Meat Consumption. Report of the Sub-committee (Franklin, M. C., Larkin, E. N., and King, C. J.) of the A.V.A. (1944.) *Aust. vet. J.* **20**. 239-243.]

This report is, in the main, based upon the published work of other workers.*

It is concluded that dogs can be adequately fed on diets containing 25 per cent. vegetable products, 50 per cent. cereal products, and 25 per cent. of animal protein in any form. Examples of such diets are given, *e.g.*, pollard, 20 parts; bran, 6; crushed barley, 25; wheat meal, 25; meat meal or meat scraps, 20; bone meal, 3; salt, 1; plus chopped vegetables, raw or cooked.

A table is given of the rationing scale compiled by N. W. Britton, of the Veterinary School, Sydney University, and used there for several years. Deleting reference to the breeds concerned, the data given are as follows:—

[*Continued at foot of col., p.* 323

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catgut sutures and the skin wound is closed by six mattress sutures of No. 17 silk, an opening being left at the bottom of the wound for drainage.

After-treatment.—Eight c.c. of "Infundin" are given intramuscularly immediately the operation is completed. This assists the expulsion of the afterbirth and acts as a preventive against shock. Thereafter a small quantity of sulphanilamide is massaged lightly over the external wound surface once every second day.

The skin sutures should be removed in from ten to 14 days.

In practically all cases healing is by first intention, the most serious sequel being an occasional stitch abscess, which latter rapidly drains out on removal of the offending suture.

Summary

The time taken for the complete operation does not exceed one and a half hours.

The successful operation is a much more economical proposition to the farmer than is a knacker cow or heifer.

Universal performance of the operation in the proper manner would enhance the reputation of the veterinary profession amongst the farming community.

Questions and Answers

"Questions and Answers" will be published on alternate weeks.
The submission of questions for inclusion in this column will be welcomed: they can relate to any aspect of veterinary work. For purposes of record, each question is numbered, and those submitting questions are required to furnish (not for publication) name and address.
Answers to readers' queries represent exclusively the personal opinions of the writers, and criticism of the replies will be appreciated.
All communications should be addressed to the Editor.

Flexor Tenotomy

Q. LXXXVIII.—*It is proposed to attempt flexor tenotomy for the relief of pronounced fetlock knuckling, due to contracted tendons, on the foreleg of an aged brood mare, vanner type. Supposing that the improvement immediately apparent, in the cast position, on section of the superficial tendon, be markedly insufficient to allow complete normal extension of the joint, would you advise section of the deep tendon forthwith; or could the additional extensor effect of the animal taking its weight on the limb, be relied on to complete a useful measure of relief?*

A.—No, do not section the deep tendon forthwith. One can only tell what will be the true state of affairs when the limb is taking the weight of the animal. It is a simple matter to section the perforans at a later date if such action should be necessary.

If your correspondent is interested in the results of tendon section he will find a short and interesting note, illustrated by photographs, by T. Lishman, in the *V.R.*, No. 1050, **21**, August 22nd, 1908, page 117. A glance at these photographs (reproduced herewith) will show the necessity for caution, for if one is too precipitate the final result may be worse than the original state of affairs.

Section of Perforatus.

Section of Perforatus and Perforans.

Complete section of suspensory ligament, in addition to perforatus and perforans.

Body Weight (lb.)	Whole Meat (per day)	Dog Biscuits (or Substitutes) (per day)	Body Weight (lb.)	Whole Meat (per day)	Dog Biscuits (or Substitutes) (per day)
5–10	2–4 oz.	1–2 oz.	50–60	1–1¼ lb.	9–10 oz.
10–15	4–6 oz.	2–3 oz.	60–75	1¼–1½ lb.	10–12 oz.
15–20	6–8 oz.	3–4 oz.	75–100	1½–2 lb.	12–15 oz.
20–30	8–10 oz.	4–6 oz.	100–150	2–3 lb.	1–1½ lb.
30–40	10–12 oz.	6–8 oz.	150–200	3 lb.	1½–2 lb.
40–50	¾–1 lb.	8–9 oz.			

*The following references may be of value to those engaged with similar problems: Arnold, A., and Elvehjem, C. A. (1939.) *J. Amer. vet. med. Ass.* **95.** 187; Govier, W. M., and Greig, M. E. (1943.) *Science.* **98.** 216; Koehn, C. J. (1940.) *J. Amer. vet. med. Ass.* **97.** 592; Linton, R. G. (1934.) *Rep. 12th Internat. vet. Cong.* **3.** 488; Morgan, A. F. (1929.) *N. Amer. Vet.* **10.** 28, and (1940.) *Ibid.* **21.** 476; Robinson, H. E., and Frederick, L. D. (1943.) *Vet. Med.* **38.** 208; Schlotthauer, C. F. (1941.) *Canad. J. comp. Med.* **5.** 36.

A. N. W.

A Joint Affection in Cattle

Q. LXXXIX.—*What is the aetiology and best method of treatment for the condition referred to in this district (Bolton) as "joint felon" in cattle?*

This consists of a hot, painful swelling affecting particularly the hock and knee joint in cattle and occasionally the elbow and stifle. Freshly calved animals appear to be particularly susceptible, more especially those coming from Ireland, and the condition is usually fatal, appearing to become pyaemic with secondary abscess formations in different parts of the body.

A.—The writer has frequently met infective conditions in the joints of cattle, but never in endemic proportions as suggested by the question.

It would appear that the first procedure should be to isolate the organism responsible. Infection with *Brucella abortus* suggests itself as a possible cause. The appropriate method of treatment may well depend upon the nature of the causal agent.

* * * * *

Paralysis in Sows After Farrowing

Q. XC.—*I am experiencing several cases of paralysis in sows five to eight weeks after farrowing. What is the most suitable treatment for cases of this nature?*

A.—Since paralysis in sows can be the result of a variety of different causes, only tentative suggestions can be put forward. A more detailed history might have reduced the number of possibilities. The following are some of the common causes:—

1. Swine fever, in which case it is highly probable that the young pigs on the sow will have died from the acute form of that disease without showing diagnostic *post-mortem lesions.* The writer has seen such a case, involving three suckling sows whose litters died without showing lesions. The sows themselves gradually wasted and typical lesions were found only in one sow, which was destroyed after lying paralysed for nearly two months.

2. Constipation is a common cause of paralysis in pigs and can usually be effectively treated by purgative doses of Istin, given as an electuary and combined with soapy enemas, to which a little glycerin has been added.

3. Milk fever will cause paralysis, but usually much earlier than five to eight weeks after farrowing, and in the cases under consideration examination of blood samples would reveal mineral deficiency.

4. Paralysis following emaciation caused by worms, especially stomach worms (*Hyostrongylus rubidus*).

5. Tuberculosis of the spinal column.

6. Deficiency of some food factor which can be supplied by feeding chopped green grass.

7. The writer has investigated an outbreak of paralysis in sows which he has suspected to be associated with a neurotrophic virus of the nature of the louping-ill virus. Such cases have always occurred in young sows.

8. Injury.

The writer of the question may, with his knowledge of the history, be able to arrive at the correct diagnosis by an elimination of the other possible causes and apply the suggested treatment. Many cases, however, are hopeless.

* * * * *

Skin Affection in Dachshund and Pekingese

Q. XCI.—*Can any reader give an explanation of a skin condition I have found in three dogs, a dachshund and two pekingese, each from a different kennel? The skin first becomes denuded of hair, mainly in the abdominal and flank region. The skin is blackish in appearance, which seems to be due to large numbers of blackheads. Pruritus is not very marked.*

Numerous skin scrapings have been taken, but no parasite can be demonstrated.

Various treatments have been tried but all have proved futile.

[As this condition is capable of being diagnosed in more than one way, we give two opinions.—*Editor.*]

A.—(1) It is difficult to visualise accurately the skin condition described, but the writer would hazard the suggestion that the lesions may be due to some endocrine disturbance. It would be of interest to know if the skin of the affected areas is thickened and if the dogs in question show any evidence of decrease in sexual character, such as infantile penis or atrophic testes, or in the case of bitches absence of oestrum.

Thyroid extract (preferably the liquid extract), possibly combined with a course of potassium iodide, might prove helpful; in the case of dogs treatment with orchic substance or testosterone, and in bitches an oestrogen may succeed when other lines of treatment fail. Naturally simultaneous local dressings of a mildly stimulant nature such as ung. acid benzoic co. should be employed.

Cases in which there are multiple infected sebaccous glands ("blackheads") usually show intense pruritus and are not usually characterised by diffuse pigmentation of the skin.

(2) It is well known that any chronic irritation of the skin in dogs is productive of black pigmentation of the affected areas. The mere mention of the name of Dachshund suggests at once the implication of the *Demodex folliculorum.* These parasites *do* set a pigmentation in the skin, do not induce pruritus, but are closely associated (especially in humans) with blackheads. The fact that the questioner did not discover any of them may be due to two factors: (1) that he did not scrape deep enough or used a poor technique, or (2) that the affection is now at an end and the parasites have disintegrated. If any treatment is still wished for, the local daily application of Novidol or Odylen is suggested.

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Correspondence

Hydrops Amnii in the Bitch

Sir,—I was most interested to read the question and answer concerning hydrops amnii in the bitch in *The Veterinary Record* of June 16th. Until December, 1944, I was not aware that this condition occurred in the bitch, and judging by discussions I have had with several of my colleagues it must be extremely rare. In view of this fact, and also of the treatment suggested in the answer given, the following cases may be of interest.

1. Seven-year Chow bitch. Had bred several litters but had a somewhat irregular breeding history. Missed when mated at the previous heat, but on this occasion showed heavy in whelp, being due December 11th. She was examined on December 13th (65th day) as no evidence of parturition was seen; there was considerable abdominal tension and foetal heads could not be palpated. The bitch was uncomfortable and very thirsty but otherwise normal. At the owner's insistence induction was attempted by the preliminary administration of stilboestrol. Approximately 24 hours after the commencement of stilboestrol therapy the bitch started to discharge copious quantities of foetal fluids. During the next few hours the bitch must have passed something approaching a gallon of fluid. As there was still no sign of parturition Caesarean section was advised but the owner refused to consent. Pituitrin was then given by injection, followed by ergometrine by the mouth. At the end of the 67th day the bitch delivered a very large, dead puppy. It was still impossible to palpate the bitch adequately and in the circumstances it was impossible to do other than await events. The bitch died on the 70th day and *post-mortem* examination revealed another large foetus at the ovarian end of the uterine cornua, over which the uterus had ruptured with subsequent peritonitis.

2. Six-year Scottie x Pekingese bitch. Had had three litters normally. The owner complained that the bitch was grossly uncomfortable during the last fortnight of pregnancy and was "bigger than she'd ever seen her."

Parturition did not commence until the 65th day and I saw the bitch when she had been straining six hours. She was very distended and tense; vaginal examination revealed an oversize foetus. Caesarean section was advised and undertaken. Operation revealed a uterus of far greater calibre than usual, the uterine wall being paper thin and splitting wherever touched. The whole procedure was complicated by copious quantities of foetal fluid; eight foetuses were removed of whom three lived. The bitch died the following day (about 24 hours post-op.) apparently from intra-uterine haemorrhage, a condition I have never seen in any previous Caesarean operation.

From the foregoing it seems reasonable to conclude that a condition of dropsy of the foetal membranes can occur in the bitch; that if the bitch goes to full term parturition is delayed, possibly with the production of oversize foetuses. But what is the cause and what the treatment? I should appreciate the views of any practitioner who has encountered this condition, together with suggestions for treatment.

Yours faithfully,

Finchley, N.3. Joan O. Joshua.

June 20th, 1945.

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[*Erratum.*—In the reply to Question LXXXIII published in our issue of June 16th, the dose of stilboestrol dipropionate given at the end of the first paragraph should read "20 to 40 mgm." and not "20 to 40 c.c."]

Weekly Wisdom

The reader has to accept, and ought to accept only, what is expressed, and to import no more; or the argument will be adulterated by yet another batch of elusive apprehensions, idiosyncrasies and prepossessions.—Clifford Allbutt, "Notes on the Composition of Scientific Papers."

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

July 2nd.—R.C.V.S. Oral Examinations begin.

July 4th.—Meeting of the Western Counties Division, N.V.M.A., at Exeter (Room 28, University College of the South-West, Gandy Street), 2 p.m.

July 11th.—Meeting of the Editorial Committee, N.V.M.A., 36, Gordon Square. W.C.1, 2.30 p.m.

July 13th.—Meeting of the North Wales Division, N.V.M.A., at Bangor (School of Agriculture, Deiniol Road), 2.30 p.m.

July 17th.—Meeting of the British Society of Animal Production at the University of Reading, 10.30 a.m.

July 20th.—Meeting of the Mid-West Division, N.V.M.A., at Bristol (Bright's Restaurant, Queen's Road, Clifton), 2.30 p.m.

July 24th.—Summer Meeting of the Eastern Counties Division, N.V.M.A., at Cambridge (Institute of Animal Pathology), 11 a.m.

July 26th.—Meeting of the South-Eastern Division, N.V.M.A., at Folkestone (Subscription Rooms, Leas Cliff Hall).

* * * * *

WINDING UP OF A.R.P. FOR ANIMALS SERVICE

Our attention has been drawn to a statement made in our issue of March 24th that the Council of the N.V.M.A. had not been consulted in the winding up of N.A.R.P.A.C. nor in the formation of the new body; it was also stated that the Council is not connected with the new organisation and that so far it is not in any way committed to "National Animal Registration." We are asked to remove any possible misapprehension which may have been conveyed to our readers by giving an explanation of the facts, which are as follows:—

From the inception of N.A.R.P.A.C. the N.V.M.A. has had one nominee on the Council of N.A.R.P.A.C., who apparently gave his support and approval of the registration of animals when this part of N.A.R.P.A.C. service was established. Later, the Registration Scheme was extended to include the veterinary treatment of animals injured in street accidents. Ratification of this extension of the original scheme has never been sanctioned by the Council of the N.V.M.A.

It appears that the nominee of the N.V.M.A. was satisfied, upon legal advice, that it was unnecessary to refer to the Council of the N.V.M.A. the decision of the N.A.R.P.A.C. Council for the winding up of that organisation and he signed with all members of the Council the deed of dissolution.

We are informed by the solicitors of the P.D.S.A. that the obligations the latter body accepted upon the winding up of N.A.R.P.A.C. have been implemented and we are also informed that "National Animal Registration" is to continue without alteration so far as regards payment of fees to veterinary surgeons.

* * * * *

Scheme for the Control of Certain Diseases of Dairy Cattle in England and Wales

The Executive of the National Veterinary Medical Association, after agreement with National Farmers' Union and the Ministry of Agriculture, recommends that undertakings under the Scheme for the Control of Certain Diseases of Dairy Cattle in England and Wales, which are due to lapse and which both parties are willing to renew on the basis of existing agreements, should be extended for twelve months.

This would mean that in respect of two or three year undertakings, the 10 per cent. and 20 per cent. rebates respectively will continue to operate.

Meanwhile, discussions between the three bodies concerned will take place and any alterations which may subsequently be agreed will be announced.

PERSONAL

Births.—Cattell.—On June 16th, 1945, at Barmouth Maternity Home, to Margaret (née Pickles), wife of G. T. Cattell, M.R.C.V.S., of Ocean View, Barmouth—a son.

Leslie.—On June 18th, 1945, at 6, Market Crescent, Castle-Douglas, to Josephine, wife of G. D. Leslie, M.R.C.V.S., a son (George Magnus).

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The Birthday Honours.—In the second list of Birthday Honours notification was made of the award of the M.B.E. to Mr. Horace Jewell, Senior Supervising Veterinary Officer, Ministry of Agriculture. Northern Ireland.

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ADDRESSES OF DISEASE-INFECTED PREMISES

Foot-and-Mouth Disease:

Herefordshire.—The Weaven Villa. Little Dewchurch, Hereford (June 19th).

Swine Fever:

Herts.—Gladwyns Farm House, Totteridge (June 18th).

Kent.—"Thistledown," Kemsley Road, Tatsfield, Westerham (June 21st); 1, Westwood Cottages, Tatsfield, Westerham (June 23rd).

Lincs.—Lincoln Road Farm, Welton, Lincoln (June 18th); Piggeries off Burgh Road, Skegness (June 19th).

Norfolk.—Rose and Crown Public House, Marham, King's Lynn (June 22nd).

Northants.—Red Cow Inn, Newborough, Peterborough (June 22nd).

Somerset.—Wick Farm, Bishops Lydeard, Taunton (June 21st); Piggeries adjoining Springfield Fat Factory, Charterhouse, Blagdon, Bristol (June 22nd).

Surrey.—Smallholding West End, Woking (June 20th).

Sussex.—50, Arundel Road, Angmering, Littlehampton (June 18th).

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AGRICULTURAL EDUCATION AND THE PRESS

In the course of his speech at the annual luncheon of The Newspaper Society, Mr. R. S. Hudson, Minister of Agriculture, said that he hoped and thought they had succeeded in their efforts to develop good relations, not only between his Department and the National Press, but also between his County War Agricultural Executive Committees and the provincial press. "What in fact we have been engaged in doing," said Mr. Hudson, "is developing a brand new technique in adult education. And in a truly British way we have done so, not as a result of a plan meticulously worked out in detail beforehand, but by a natural process of development and growth, meeting difficulties as they arose, improvising new methods to meet new needs and then polishing and perfecting them. I think I can claim without fear of contradiction that there is no other industry in Great Britain to-day where such a leaven of new ideas, new processes, new outlook is fermenting and effervescing. Liberated from years of apathy and despair with their deadening effect on men's minds and spirits, farmers young and old, especially young—and I use the word farmer in its widest sense—are thirsting for knowledge and very willing to try new methods. Often new methods are but revivals of practices indulged in by our grandfathers but forgotten under the economic impact of 19th century laissez faire. There is a demand for meetings, talks, demonstrations which we are finding it difficult to satisfy. In all this the local press has played a vital part. The great trade papers have done their bit. But their editors and owners would be the first to acknowledge that the local paper has the great advantage of being able to translate general principles into local practice, and equally important, often to reproduce official jargon in language understandable by their local readers.

"You will see, therefore, how deeply I appreciate your help and you will understand why I attach such importance to the establishment of good relations between ourselves and the Press. I believe that this will be more than ever true of the future, especially the immediate future. With the last shreds of the Wehrmacht's power and reputation destroyed, I hope for ever, and with the war against Japan marching to its predestined end, the people of this country might be excused for a feeling that our troubles were over and that we can sit back and relax. Whatever may be the case on other fronts, that will not be true as you know on the Food Production front. We and the world will be short of food. We in this country will need a continuance of maximum effort by our farmers and farm workers. They in turn will need maximum help from the civilian population even after taking into account the maximum use we can make of German and Italian prisoners. It is not going to be easy to put that over. We could not begin to do it without your help. Indeed we shall rely chiefly on you to ensure the success of our Lend a Hand on the Land campaign."

NEW MOTOR CARS

The Association has been in communication with the Ministry of War Transport regarding the allocation of new cars for the use of veterinary surgeons and is advised "that licences will be granted to veterinary surgeons who, in making their application, establish genuine need for a new car." Application for such a licence should be addressed to the Director General, Ministry of War Transport, 2-3, Fitzmaurice Place, Berkeley Square, London, W.1.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

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VETERINARY EDUCATION

Sir,—The meaning of the term "uni-portal" as applied to veterinary education is susceptible to more than one interpretation, as correspondence in your columns has amply testified. The meaning attached to the recommendation on this question by the Loveday Committee should have been clear to all from the Report. On page 14 the following relevant passage occurs:—

> "Acceptance of our recommendations would mean that membership of the Royal College would continue to be the licence to practise, but membership would be open not only to those candidates who had passed all the diploma examinations conducted by the Royal College but also to those who had obtained a registrable degree in veterinary medicine at a University authorised by the Privy Council to grant such a degree.
>
> "As membership of the R.C.V.S. will remain the only means of entry to the profession, and as the Council of the R.C.V.S. is to have additional powers to ensure a satisfactory standard, the essence of the 'one-portal system' will be preserved."

As is usual with the leaders of a losing battle the flag of obstruction to progress is attached to the standard of some such generalised cry as "hands off the cherished heritage won for us by our progressive forefathers." As a slogan for such a standard in the discussions on the possible improvement in veterinary education the cry of "the one-portal system," as narrowly interpreted, is eminently serviceable. It is no doubt for this reason that the opponents of the Loveday Report restrict their comments almost entirely to this question and ignore the fundamental issue before the profession, which issue is—what are the best conditions for the continued improvement of veterinary education, both to ensure advancement of all branches of veterinary science and the highest service which the profession can offer to the nation?

It appears to be agreed by nearly everybody within the profession that veterinary education should be much more closely linked with university education, yet despite this decision many of us appear to be afraid to agree to conditions which will secure the maximum benefit from this association. The suggestion that the universities would lower the standard of our professional education is just fantastic. It is much more likely that one or other of them might attempt to raise the standard too high. It is equally fantastic to imagine that the universities would ever appoint other than practising members of the veterinary profession as their external examiners in vocational subjects. Unfortunately, the popular cry raised by Mr. Lishman and his colleagues goes at the very root of the one essential to success in university co-operation, namely, professional confidence in the universities and that of the universities in the profession. With mutual confidence there would be no cause for these protracted debates and discussions.

The results of the recent election were encouraging to those in favour of full university co-operation in our education in that they completely refute the oft-repeated statements made by the diehards to the effect that practically nobody within the profession is in favour of the Loveday recommendations. In actual fact, even on the basis of the claims put forward by Mr. Lishman and Dr. J. T. Edwards, the total votes given to the so-called "one-portal candidates" was 8,883 in contrast to 5,135 given to the alleged supporters of the Loveday Report; that is to say over 36 per cent. of the total votes recorded were for the Report. When taken in conjunction with the almost equal voting for the two candidates heading the list (Dawes 10,050, Dalling 990), the election addresses of whom were specifically against and in favour of the Report, this, I submit, indicates clearly that a substantial proportion of the profession is in favour of the progressive development of veterinary education along the general lines recommended by the Loveday Report.

Despite these facts and the pressing need to secure the present opportunity for full university co-operation with the profession, my legal friend, Mr. Lishman, will doubtless happily continue to imply that the issue before the profession is not so much a question of improvement of our system of education but one of whether the present "one-portal system," as defined by him, should remain intact. With rather less reverence for past enactments but with greater concern for the prospects of the future, a growing proportion of the profession feels that a more fluid system of veterinary education, with professional control over the standard of qualification, will materially affect professional progress.

Yours faithfully,

Bentley Hyde, Priory Drive, Stanmore, Middlesex. W. R. Wooldridge.

June 21st, 1945.

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"SOME TOPICAL COMMENTS"

A Study of the Immunological Properties and Infectivity of Brucella Abortus Strain 45/20, McEwen, in Cattle

Sir,—One must pay ungrudging tribute to the authors of this Report for the evident care and diligent attention which they have taken in its preparation. There is, however, one very disquieting aspect of it which many will think calls for explanation. It would appear that the experiments were completed, or very nearly completed at the end of 1941—the last milk examinations being taken on December 11th, 1941, though further blood samples were taken on January 1st, 1942, and February 2nd, 1942. It therefore follows that such evidence as there was against 45/20 vaccine was known early in 1942. That being so, it is difficult to understand why the use of No. 2 vaccine was permitted in the Control Scheme which did not start until June, 1942, and over two years were allowed to elapse before official approval of it was withdrawn; yet, so far as one is able to ascertain, no additional or supplementary evidence against it has been adduced.

Further, assurance was given that the reports on both strains 45/20 and 19 would be available for publication before the end of 1944, and then early in 1945; subsequently, when the report on 45/20 was received it was accompanied by a request that publication be withheld until the report on strain 19 came to hand so that the two reports could appear in consecutive issues of the *Record*. I now learn that the release of the strain 19 report is indefinitely postponed. The whole business seems to be wrapped in mystery which time will, perhaps, unfold.

Government and Animal Diseases

Quoting the N.F.U. Record *The Veterinary Record*, on page 271, says "The industry's next step was to press for a 'Panel Scheme,' and the Ministry of Agriculture helped to sponsor it. With the National Farmers' Union and the Milk Marketing Board they entered into negotiations with the veterinary profession for a scale of charges that would enable whole herds to be visited regularly by veterinary surgeons." So now we know how the Control Scheme came into being—and many of us thought that the N.V.M.A. had something to do with its introduction—well, well! I wonder where the N.F.U. get their information from?

A notable omission from this citation of complaints against the Government is the suspension of the Licensing of Bulls Act; an act of folly, the effects of which will be felt for many years.

Restraint of Bulls

I thought that most veterinary surgeons engaged in cattle practice knew that the most effective way of restraining bovines for any operation on their nether regions was to have the tail elevated to its fullest extent, one hand being placed underneath the tail near its base. This will definitely prevent any serious kicking.

The Use of Barium Chloride Intravenously

I should like to support Mr. Auchterlonie in recommending the use of this drug, not only for equines, but also for bovines. It was as the result of a demonstration given by Mr. Auchterlonie to the Derbyshire Division of the N.V.M.A. that I first became interested in barium chloride. Since then I have used it extensively and with uniformly good results. I believe that the margin of safety is also considerable as on one occasion one of my assistants in error gave 40 grains in one dose without any ill-effect.

Yours faithfully,

28, Lichfield Street, Tamworth, Staffordshire. H. W. Steele-Bodger.

June 13th, 1945.

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R.C.V.S. COUNCIL ELECTION

Sir,—May I be allowed to express through your correspondence columns my very sincere thanks to those who voted for me in the recent election to the Council of the R.C.V.S. It will be my earnest hope and endeavour to justify their confidence and to serve the interests of the profession.

Yours faithfully,

Bath. Esmond Brown.

June 23rd, 1945.